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THE CITY: ITS DISTANCE FROM NATURE

YI-FU TUAN

WHAT is the essential character of the city? Many scholars have tried to answer this question, but they do not often agree. Some are eager to arrive at a statistical measure: at its simplest, a city is a settlement of a certain size. Others have in mind an ideal type, approached perhaps by the Greek polis or a Renaissance city-state, and urban places are then judged in accordance with how closely they conform to the ideal. Thus a settlement may be deemed too small or too agricultural in its major functions; on the other hand, Imperial Rome or a modern metropolis may be deemed too large and lacking in physical as well as in sociopolitical coherence. A third group of scholars look at the statement "the nature of the city" and understand the word "nature" to carry the sense of "origin." To know the nature or essence of a thing—whether it be tragic drama, religion, or the city—one must seek its primitive forms. This viewpoint may be characterized as etymological, because it tends to identify true meaning with root meaning.¹

It is futile to seek a definition of the city that commands universal assent. We ask different questions and necessarily arrive at different answers. This does not mean, however, that all answers are equally arbitrary or revealing. For instance, few scholars think the statistical criterion, used alone, is satisfactory. From experience we know that cities differ in the character and intensity of their urban life. The problem is to conceive of a scale that is least arbitrary. The one I shall explore is based on the idea that cities are artifacts and worlds of artifice placed at varying distances from human conditions close to nature. I assume that a life close to nature is bound to food production and to the needs of survival, that it follows closely the natural rhythms of day and night and of the seasons.

Cities, then, may be ranked according to how far they depart from farm life, from the agricultural rhythm of peak activity in the warm half of the year, and from the cycle of work during the day and of sleep at night. At one end of the scale we have the village subordinate to nature; at the other, the city that does not know how it is fed, that comes alive in winter and slights the daily course of the sun. These three physical

¹ In the late nineteenth century a revolution in thought made men "turn away from the classic notion that the essential nature of an object is best grasped by studying it in its ideal perfection, or at least in its full development, to the romantic notion that its essential nature is to be found in its primitive form" (Helen Gardner: *Religion and Literature* [Faber and Faber, London, 1971], p. 31). On identifying true meaning with root meaning, see G. B. Tennyson: *Etymology and Meaning, in Evolution of Consciousness* (edited by Shirley Sugerman; Wesleyan Univ. Press, Middletown, Conn., 1976), pp. 168–182.

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criteria are a convenient measure of the distance we have moved from nature to artifice.

CUTTING AGRICULTURAL TIES

Sumerian and Akkadian languages did not distinguish between village and city: both types of settlement were called *uru* in Sumerian and *ālu* in Akkadian. These terms applied to any permanent cluster of houses made of sun-dried mud bricks. An enclosing wall seems to have been the rule, but it was not a prerequisite. Ensuring food supply was never far from the minds of the Mesopotamians, even for those who lived within the walled compound. A typical Sumerian city included a walled area that contained the temple or temples, the palace with the residences of the royal officials, and the houses of the citizens. We are perhaps too impressed by this monumental core, forgetting that it was closely tied to the *uru.bar.ra*, the Sumerian for "outer city." This outskirts might be protected by a secondary wall or fortified outposts like those mentioned in the Neo-Babylonian period. Within the outer city were clusters of houses, farms, cattle folds, fields, and gardens.²

The traditional Chinese city had a distinctly rural character. During the Han period (206 B.C.–A.D. 220) the capital, Ch'ang-an, was subdivided into some hundred and sixty wards. The Chinese character for "ward" is *li*, which today designates the Chinese mile as well as a village or hamlet. The use of the word *li* suggests that Han Ch'ang-an was not covered by streets and built-up districts; rather, large parts within the walls contained fields, farms, and villages.³ During the T'ang Dynasty (A.D. 618–907), Ch'ang-an was a huge metropolis with a population that approached a million. Streets were broad and might have occupied 19 percent of the area. Yet about a third of the land in the southern part of the walled city was sparsely settled and given over to fields, farms, and a famous park.⁴ Because at the start of a new reign the capital city was often built on open land and because the walls were among the first structures to be erected, we may think that the people were too few to fill—or lacked the time to increase and fill—the empty areas within the walled compound. On the other hand, we have evidence of deliberate prohibition. A decree of A.D. 932 forbade the construction of houses on fields in certain districts. Moreover, the imperial compound itself contained gardens and fields, not only pleasure parks.⁵ The Chinese city, as late as the 1920's, presented a rural mien. When a visitor entered the city through one of its less frequented gates, he was likely to see not a busy street lined with shops but fields, market gardens, and duck ponds.⁶

The European medieval city had extensive open spaces for farming and orchards. Such areas could exist within the walls because the characteristic shape of a large medieval settlement was that of a starfish rather than one of concentric rings. At the center lay a densely settled core, from which radiated arms of houses along the arterial roads that led to the city gates. The roughly triangular areas left between the

² A. Leo Oppenheim: *Ancient Mesopotamia* (Univ. of Chicago Press, Chicago, 1974), pp. 115–116.

³ Etienne Balazs: *Chinese Civilization and Bureaucracy* (Yale Univ. Press, New Haven, Conn., 1964), p. 68.

⁴ Ping-ti Ho: Lo-yang, A.D. 495–534: A Study of Physical and Socio-Economic Planning of a Metropolitan Area, *Harvard Journ. Asiatic Studies*, Vol. 26, 1966, pp. 52–101, reference on pp. 69 and 81.

⁵ Wolfram Eberhard: *Settlement and Social Change in Asia* (Hong Kong Univ. Press, Hong Kong, 1967), p. 51.

⁶ O. Siren: *The Walls and Gates of Peking* (John Lane, London, 1924), p. 4.

radiating roads were sparsely occupied until as late as the middle of the nineteenth century. Houses were scattered amid fields and vegetables gardens, forming wedges of country life within the city—even close to its core. In Paris the Left Bank of the city had remained a semiurban expanse of vineyards even after its enclosure with the wall of Philip Augustus around 1200.⁷

German medieval cities embraced vineyards, cherry orchards, and vegetable and flower gardens within their ramparts. Skirting these food-producing areas were dirty streets lined with farmers' cottages, before which stood stately heaps of manure. D. C. Munro and G. C. Sellery, adapting Karl Lamprecht's work, wrote:

Most cities were still to a very great extent engaged in agriculture. At Coblenz, in the second half of the thirteenth century, work on the city walls had to be given up during harvest time, because of the lack of workmen; at Frankfort in the year 1387 the city employed four herdsmen and six field-guards, and even in the fifteenth century a strict law was enacted against allowing pigs to run about the city streets. Even in the largest cities there are very many indications of an extended population engaged in agriculture. Cattle-breeding and gardening were common activities along with manufacturing and trade; in fact, the former had their own location in the country before the gates, as well as in the parts of the city which lay nearest the walls.⁸

Shakespeare's London occupied an area of one square mile, and within it probably dwelt some 100,000 people. It was a pleasant country town with many gardens and broad green fields close to the most crowded streets. Chattering birds provided a common sound in the background and wild flowers could be picked by anyone who walked for twenty minutes. Nature was close at hand for every Londoner with eyes to see.⁹ At the end of the eighteenth century, Paris included many permanent residents who were engaged in country pursuits such as market gardening and the breeding of rabbits. "In revolutionary Paris," wrote Richard Cobb, "chickens were as much at home as canaries in the upper floors, flower-pots were frequently reported to the *commissaire* as falling from attics, and the streets themselves teemed with animalia led by rustic types."¹⁰

Such intrusions of the country into the city are perhaps not surprising. We expect agriculture to play an important role in the city before the Industrial Revolution. But what about the city in the nineteenth century? From the writings of English reformers and novelists (particularly Charles Dickens), we have gained an image of sprawling crowded warrens, half buried in industrial filth, that bear no hint of rural activity. This popular urban image appears to be misleading. H. J. Dyos and Michael Wolff wrote:

In the nineteenth century no English city had severed itself from its rural connections. The largest of them still conducted extensive backyard agriculture, not merely half-a-dozen hens in a coop of soapboxes, but cow-stalls, sheep-folds, pig-sties above and

⁷ Howard Saalman: *Medieval Cities* (George Braziller, New York, 1968), pp. 24-25 and 40.

⁸ D. C. Munro and G. C. Sellery: *Medieval Civilization* (Century Co., New York, 1910), pp. 362-363; translated and adapted from Karl Lamprecht: *Deutsche Geschichte* (R. Gaertners, Berlin, 1896), Vol. 4, pp. 211-217.

⁹ Norman G. Brett-James: *The Growth of Stuart London* (George Allen & Unwin, London, 1935), pp. 27-28.

¹⁰ Richard Cobb: *The Police and the People: French Popular Protest, 1789-1820* (Oxford Univ. Press, London, 1970), p. 223.

below ground, in and out of dwellings, on and off the streets, wherever this rudimentary factory-farming could be made to work.¹¹

I have considered agriculture as it was practiced on a fairly large scale within the city. Turn now, briefly, to the garden, for in its checkered history we can trace once more the theme of the city as the attenuation of nature and of the livelihood sustained by it. The garden is an artifice, but the degree of artifice can vary, depending on whether a particular plot is utilitarian, decorative, or a mixture of the two.

In ancient Egypt (ca. 1400 B.C.) the value of land in the city core prohibited large gardens. Occasionally, fruit trees such as the date palm were planted along the side of a domicile. The importance of the garden to Egyptian life is nonetheless demonstrated by the fact that it was attached to all kinds of structures—palaces, temples, chapels, and country houses. Formal in arrangement, an Egyptian garden contained vegetable plots and fruit trees as well as decorative plants.¹²

Did ancient Greek cities have vegetable or flower gardens? We have little evidence of either. We do know that the Athenians, proud as they were of their public roles in the city, also had intimate knowledge of agriculture. They knew agriculture from experience: around 400 B.C., three-quarters of the Athenian burghers had farms in Attica.¹³ Religious festivals also show how the Greeks were deeply involved with the seasonal rhythms of plant and animal life. Pot gardening may owe its origin to the Greeks. Their women planted quick-growing seeds of lettuce, fennel, wheat, or barley in earthenware for the festival of Adonis. The potted plants decorated statues of Adonis and were placed on the flat housetops during the period of this summer festival. From religious symbolism to the display of other plants for their decorative beauty was only a short step.¹⁴

Early Roman gardeners did not distinguish between useful and ornamental planting. Roses and violets were grown side by side with leeks. Not until Pliny the Younger (A.D. 62?–ca. 113) was any separation noticed.¹⁵ In the first century A.D., wealthy Romans had sumptuous villas in the country. How did ordinary citizens establish contact with nature in the crowded capital? Public parks provided temporary relief. In the multistoried tenement houses, which were the most common type of dwelling in Rome, the people could at best manage only windowsill pot gardens and trained plants on the balconies.¹⁶

Some time before the year 1183, William Fitz Stephen described London as a city of gardens "planted with trees, spacious and fair, adjoining one another."¹⁷ The typical medieval garden had two divisions, one for herbs and kitchen vegetables, the

¹¹ H. J. Dyos and Michael Wolff: *The Way We Live Now, in The Victorian City: Images and Reality* (edited by H. J. Dyos and Michael Wolff; 2 vols.; Routledge & Kegan Paul, London, 1973), Vol. 2, pp. 893–907, reference on p. 899.

¹² Alexander Badawy: *A History of Egyptian Architecture* (Univ. of California Press, Berkeley and Los Angeles, 1968), pp. 488–490.

¹³ Lewis Mumford: *The City in History* (Harcourt, Brace & World, New York, 1961), p. 128. Mumford's authority is Elizabeth Visser: *Polis en Stadt* (Swets & Zeitlinger, Amsterdam, 1947).

¹⁴ Julia Berrall: *The Garden* (Viking Press, New York, 1966), p. 32. See also Martin P. Nilsson: *Greek Folk Religion* (Univ. of Pennsylvania Press, Philadelphia, 1972), p. 96.

¹⁵ Richardson Wright: *The Story of Gardening* (Dover Publications, New York, 1963), p. 81.

¹⁶ Jérôme Carcopino: *Daily Life in Ancient Rome* (Yale Univ. Press, New Haven, Conn., 1940), p. 81. On the same page, Carcopino surmised: "In the most stifling corners of the great city these flowers assuaged somewhat the homesickness for the countryside which lay heavy on the humble town dweller sprung from a long line of peasant ancestors."

¹⁷ William Fitz Stephen: *A Description of London, in Norman London* (edited by F. M. Stenton; *Hist. Assn. Leaflets*, Nos. 93–94, London, 1934), pp. 26–32, reference on p. 27.

other—containing flowers and fruit trees—for promenade and enjoyment. A garden made for beauty and pleasure alone was a later innovation. According to Richardson Wright, it did not appear “on the Continent until the fifteenth century and in England until Queen Elizabeth’s time.”¹⁸ We would naturally expect that only the rich could afford gardens for beauty while the common man must make do with a garden for use; but the interesting fact is that in Elizabeth’s reign, sophisticated Londoners found delight in utilitarian gardens. John Gerard published his massive folio “Herball” in 1597. He was a pioneer in horticulture. His own garden contained not only many flowers but also such mundane plants as turnips and lettuces. He even tried to raise potatoes and the sugarcane, though without success. Following him, in the seventeenth century, was a succession of distinguished writers on gardening which included Sir Thomas Browne, Andrew Marvell, Abraham Crowley, Sir William Temple, and John Evelyn.¹⁹ Increasingly, London itself could not accommodate gardens of any scale—these grand and formal designs appeared in the suburbs and on country estates. London, however, was able to retain a rustic air through its vines in tavern yards and its fruit trees such as the apple, the pear, and the fig, which flourished in numerous confined alleys and courts despite pollution from the burning of “sea coal.”²⁰

Open spaces contracted rapidly as the urban population swelled in the eighteenth and nineteenth centuries. Early in the nineteenth century, Birmingham already saw the need to provide its less affluent citizens with allotments, both outside and inside the city, where people could (on weekends) maintain contact with nature by growing flowers and vegetables.²¹ In England, as the urban environment continued to deteriorate with industrialization, the importance of allotment gardens was widely recognized. In Germany the movement to provide small plots of agricultural land to city tenement dwellers began in the 1870’s. Many towns on the Continent, particularly in Germany, are still conspicuously girdled by miniature farms.²²

What about the contemporary North American metropolis? Its downtown area seems farthest removed from nature. From a high point, one sees nothing but buildings, streets, and parking lots—and in Los Angeles if a person detects a few trees he should not be surprised to find them made of plastic.²³ Yet the need for contact with nature has not altogether vanished. A stroll in the city park cannot wholly assuage such need. Intimate contact with nature means working on it and possibly obtaining food from it, and these opportunities the park cannot provide. The New Yorker’s solution is the roof garden. In the 1950’s several thousand New Yorkers—some rich, some poor—used their miniature rake and hoe to cultivate their skyline plots. The *New York Times* reported in 1958 that the most knowledgeable top-floor husbandman is a freelance writer on horticulture. “He has more than 2,000 plantings on the eleventh floor at 1394 Lexington Avenue, near Ninety-second Street. His crop includes figs, bananas, strawberries, peaches, cherries. He maintains a rich compost heap of leaf mold and kitchen leavings.”²⁴

¹⁸ Wright, *op. cit.* [see footnote 15 above], p. 105. See also P. J. Jarvis: North American Plants and Horticultural Innovation in England, 1550–1700, *Geogr. Rev.*, Vol. 63, 1973, pp. 492–499.

¹⁹ Brett-James, *op. cit.* [see footnote 9 above], pp. 444–446.

²⁰ *Ibid.*, pp. 468–469.

²¹ Conrad Gill: History of Birmingham (2 vols.; Oxford Univ. Press, London, 1952), Vol. 1, pp. 123–124.

²² Robert E. Dickinson: The West European City (Routledge and Kegan Paul, London, 1961), p. 259.

²³ Martin H. Krieger: What’s Wrong with Plastic Trees? *Science*, Vol. 179, 1973, pp. 446–455.

²⁴ Meyer Berger: Rooftop Gardeners Bring Forth Blossoms High Above a City of Stone and Steel, *New*

CIVILIZING WINTER

The city, as a shelter, protects human beings against nature's vagaries. In the tropics the need for such protection is minimal; likewise in the middle and high latitudes during the warm season. Summer allows people to be natural: it is the time of the year when they can work or play in the field. Winter returns them to urban society—to the built environment and the world of artifice. The city comes into its own in winter, when the countryside lies dormant and barren. At a minimum the city can feed its people with stored food in a lean season; it is also warmer and less exposed to biting winds than are the open fields. At best the city defies cold, snow, and long dark nights by becoming a glittering, magical world of culture and entertainment.

The city has its seasons, which are the reverse of the countryside's calendar of activities. In China during the early part of the Chou Dynasty (1027–256 B.C.), the conquering rulers organized their tribesmen into semimilitary cadres of eight families each. Groups of people left their fortified town in early spring, worked and lived on the land through the summer, and returned to the town after harvest. Wolfram Eberhard wrote: "This type of settlement implied a sharp division of the year into two parts: winter life in the city, summer life in the fields. Ceremonies such as the 'new fire ceremony' or 'bringing the fire out' (i.e. to the fields), the constant interplay of Yin and Yang in Chinese philosophy and other things reflected these conditions, which might be seen as a movement from duality to dualism." Eberhard further noted that the change of work and residence with the seasons was not limited to China. Seminomadic tribes in Central Asia also practiced this form of life. In winter they lived in a walled city, but as summer approached they would take their tents and go up to the mountain flats and live there like nomads. Some of the tribes adopted agriculture: in winter they dwelt in the city as before, but with the return of the warm season they moved to the hillslopes, set up simple straw huts, and cultivated grapes, fruit trees, and vegetable gardens. Great festivals marked the transition from one style of life to the other.²⁵

Lewis Mumford reminds us that the Greek cities in their formative period never lost their connections with their countryside or their villages: there was, he said, "a tidal drifting in and out of the city with the seasons."²⁶ The prolonged Peloponnesian War (431–404 B.C.) interrupted this tidal movement. Many countrymen, shut up within the city walls, were homesick for their farms and complained bitterly.²⁷ In the first century A.D., public functions in Rome slowed down during the summer months. The courts were closed in July. Many wealthy Romans owned both a town house and a suburban villa. They lived in the city in winter, repaired to the suburbs in spring and autumn, and sought the coolness of the seaside when summer heat became intolerable.²⁸

Seasonal movements of this kind were and are a common practice of affluent

York Times, Apr. 23, 1958; reprinted in Anselm L. Strauss: *The American City: A Sourcebook of Urban Imagery* (Aldine Publishing Co., Chicago, 1968), pp. 385–386.

²⁵ Wolfram Eberhard: *Conquerors and Rulers: Social Forces in Medieval China* (E. J. Brill, Leiden, 1965), pp. 35–36.

²⁶ Mumford, *op. cit.* [see footnote 13 above], p. 128.

²⁷ S. H. Butcher: *Some Aspects of the Greek Genius* (Macmillan, London, 1893), p. 257.

²⁸ Ludwig Friedländer: *Roman Life and Manners Under the Early Empire* (4 vols.; Barnes & Noble, New York, 1968), Vol. 2, p. 193.

citizens. In Renaissance Florence a fairly well-to-do citizen probably owned a place in town, a shop where he worked, and a villa or farm in the suburbs. Numerous country houses and villas surrounded Florence. A prosperous merchant might have an estate beyond the city walls, which supplied him with vegetables, wine, oil, forage, and wood. Depending on the time of the year, he was a city sophisticate or a gentleman farmer.²⁹ The character and tempo of activity in Florentine streets and squares, in loggias and public buildings, changed with the seasons. Winters could be cold and bleak. Citizens remained indoors whenever possible. On the other hand, religious fervor was particularly intense between Christmas and Epiphany and during the Lenten season. The city defied winter and came to life in response to religious events, which were a form of theater. Gene A. Bruckner observed: "Thousands flocked into the cathedral every evening during Lent to hear the sermons of famous preachers, who were hired by the commune for the season. Each religious holiday featured a public ceremony in which both clergy and laity participated."³⁰ Spring was the liveliest time in Renaissance Florence as it is today: merchants were eager to do business, pilgrims poured in on their way to Rome, vagabonds and pickpockets emerged, attracted by the crowds. Midsummer, however, was a dead season. The stifling heat and nauseous smells of the city became insufferable. Since the fourteenth century, Florentine patricians have left it every summer for their country villas, returning to their urban palaces in late September or October.³¹

"Fermeture annuelle." To the hungry tourists who swarm over Paris in August, few signs are as ubiquitous and as unwelcome. Paris, like many other metropolitan centers, is abandoned by its well-to-do natives in summer. Cultural life slows down or tends to offer light fare commensurate with the mood of the season and with the unsophisticated taste of gawking visitors. *Saturday Review*, in a special issue entitled "Cities in Winter," focuses on the metropolis as artifice—a human creation that is most vital when nature herself sleeps. Thus Horace Sutton intones editorially:

Cities bloom with the first chill winds. Urban forests are the inverse phenomenon of trees and flowers. They sprout with plumage as the winter descends. For it is then, amid the flakes and the gusts, that shoppers hustle, that stores burgeon into brightly lit bazaars. . . . The cities in winter are nurtured by the warmth of the café, nourished by the expectant bubble of audiences before curtain rise. Museums burst effervescently into flower. Ancient civilizations creep from storages and assemble in galleries like fragments of far-flung clans called to convention by tribal drums heard only by the membership.³²

In the same issue of the magazine, other writers offer vignettes on selected cities. At one level these vignettes are mere calendars of cultural events; at another they remind us of an easily overlooked fact—that cultural life and the human imagination can soar when the delights of nature are in temporary abeyance. "Muscovites," observed Leona Schecter, "are uneasy at the end of autumn, before winter takes hold. They say they feel better when the real freeze comes, the hard-edged cold that clears the air of vapors and dangerous viruses." Of course winter is the season for attending the repertory theaters, the Bolshoi, and the grand-opera productions and ballet

²⁹ J. Lucas-Dubreton: *Daily Life in Florence in the Times of the Medici* (George Allen & Unwin, London, 1960), p. 95.

³⁰ Gene A. Bruckner: *Renaissance Florence* (John Wiley, New York, 1969), p. 44.

³¹ *Ibid.*, p. 43.

³² Horace Sutton: *Cities in Winter* [Introduction], *Saturday Rev.*, Jan. 8, 1977, p. 11.

performances at the Kremlin's Palace of Congresses, but perhaps it is in the modest art of cooking that we most directly recognize the triumph of human ingenuity over nature. What is the best time to appreciate the heavy Russian cuisine? Winter. "Coming in from the sharp cold to the Aragvi, one of Moscow's best restaurants, a shot of chilled vodka . . . warms the blood. The waiter approaches each person at the table with hot Georgian flatbreads, wrapped in damask, so they can pull off a piece for themselves and warm their hands on it while they apply butter that quickly melts between the crusts."³³

On isolated farms and in small towns beyond the subtropics, winter is a state of siege from which the people look for deliverance in spring. Not so in a bustling metropolis. In New York City, says Richard Eder,

It isn't in the spring that people think to themselves: "Well, we made it through another year." That comes some late-autumn afternoon when the air has turned very clear, and suddenly we smell roasting chestnuts just north of St. Patrick's Cathedral. The city lives at cross-purposes with nature: cold, not heat, brings it to life.

It is during the fall and winter that the sense of renewal is at its height. Look what gets born in New York. SoHo, the loft district below Greenwich Village, is a whole new cultural center, with art galleries, experimental theaters, and bars that serve up hamburgers and rough chic. The once-depressing side streets off First and Second avenues are now among the most cheerful and attractive in the city. Even Hell's Kitchen, grim as it still looks, begins to show signs of polish here and there. New York keeps regenerating itself.³⁴

CONQUERING NIGHT

Commonly perceived types of primordial chaos are wasteland, wide expanses of water, and darkness. Of these three types, the imposition of spatial order on wasteland was the easiest to accomplish: walls that enclosed a settlement and thus defined humanized space were raised some eight or nine thousand years ago. The conquest of water took longer: the drainage of marshes and swamps presented technical problems that were overcome only in the historical period. Darkness proved to be nature's greatest challenge to human ingenuity. Candles and open-flame oil lamps, already in use when the Pyramids were built, remained the most common form of illumination until the approach of the nineteenth century. These primitive devices made only the feeblest inroads on the night. Conquest of darkness on any large scale came with the introduction of gaslight in the nineteenth century. But it is only with the wide use of electricity in the twentieth century that we can truly say—in some cities—that the day has swallowed the night and that human beings have learned to curtail a fundamental rhythm of nature.

The city becomes progressively artificial as it ignores the distinction between day and night. Today, we almost identify "city life" with "night life." The quality of a city's night life is a measure of its sophistication. It is easy to forget that although the city has ancient roots, its evening glitter is recent. Leo Oppenheim described the

³³ Leona Schecter: Moscow, *Saturday Rev.*, Jan. 8, 1977, pp. 13–15, reference on p. 14.

³⁴ Richard Eder: New York, *Saturday Rev.*, Jan. 8, 1977, pp. 25–28, reference on p. 25. I have condensed Eder's paragraphs,

"busy hum of man" in a Sumerian city, and then added: "Indeed the noises and bustle of a city day, the eternal coming and going, was effectively contrasted by the poets with the quiet nights when the city slept under the starry sky, behind locked gates. Only the night watchmen made their rounds."³⁶ Imperial Rome, a city of vast size and splendor, submitted to the rhythm of day and night like any provincial town. Jérôme Carcopino wrote:

[One fact] most markedly distinguished Imperial Rome from contemporary cities: when there was no moon its streets were plunged in impenetrable darkness. No oil lamps lighted them, no candles were affixed to the walls; no lanterns were hung over the lintel of the doors, save on festive occasions. . . . In normal times night fell over the city like the shadow of a great danger, diffused, sinister, and menacing. Everyone fled to his home, shut himself in, and barricaded the entrance. The shops fell silent, safety chains were drawn across behind the leaves of the doors; the shutters of the flats were closed and the pots of flowers withdrawn from the windows they had adorned.³⁸

In traditional China as in medieval Europe and early colonial America, curfew was imposed on towns after dark. Curfew protected citizens from the twin threats of fire and strangers. However impressed we may be with images of bustling life in a preindustrial city, we should remember that in many instances all public and outdoor activities ceased with the toll of the curfew bell. Night belonged to the biological and private sphere. It was the time for recuperation and for entertainment in the privacy of the household. This was true even of Renaissance Florence, a place we associate with high art and culture. Exceptional occasions permitted the city to come to life after dark. In China, these would include the great celebrations of New Year and the emperor's birthday. In ancient Rome the Feast of Flora was a nighttime activity and called for spectacular lighting.³⁷ Scattered evidence shows that illumination also occurred on a regular basis. For example, Antioch in the fourth century A.D. was brightly lit at night; nonetheless street lighting must have been rare because Antioch citizens took special pride in it.³⁸ In China, Hang-chou boasted a vigorous night life along the crowded Imperial Way before the Mongols invaded the Sung capital in A.D. 1276. The Mongols ended Hang-chou's bustle and glitter by imposing strict curfew.³⁹

Although a few premodern cities tried to extend day into night, they were the exceptions. The rule was to live by the sun. Paris in the sixteenth century could not even dream of becoming the "City of Lights." Efforts to persuade Parisians living in the lower stories of houses to keep candles at their windows during the early evening hours met with little success. The first impetus toward efficient illumination came in the year 1667, when Gabriel Nicolas de la Reynie—Paris's powerful Lieutenant of Police—ordered some 6,500 lanterns to be strung across the streets. By the end of the seventeenth century, candles illuminated some sixty-five miles of city streets during the winter months.⁴⁰ As for London, in 1662 an act of Parliament required every household whose house fronted a street to hang out a candle tall enough to burn from

³⁶ Oppenheim, *op. cit.* [see footnote 2 above], p. 142.

³⁸ Carcopino, *op. cit.* [see footnote 16 above], p. 47.

³⁷ Friedländer, *op. cit.* [see footnote 28 above], p. 13.

³⁸ A. H. M. Jones: *The Greek City from Alexander to Justinian* (Clarendon Press, Oxford, 1940), p. 214.

³⁹ Jacques Gernet: *Daily Life in China on the Eve of the Mongol Invasion, 1250-1276* (George Allen & Unwin, London, 1962), p. 36.

⁴⁰ Leon Bernard: *The Emerging City: Paris in the Age of Louis XIV* (Duke Univ. Press, Durham, N.C., 1970), pp. 162-166.

dusk to nine o'clock. In 1716 the hours of lighting were extended to eleven o'clock in the evening between Michaelmas and Lady Day. Lighting had improved but London was still left without lamps or lanterns for 247 nights in the year; moreover, after eleven o'clock the streets were plunged into nocturnal gloom. The lamps themselves were so feeble that their glimmer barely pierced the darkness; and people who ventured out at night, whether on foot or in a carriage, still had to be led by a linkboy.⁴¹

More than the cold the long hours of darkness in winter were perceived to be a threat to civil life. In the second half of the seventeenth century, several European cities—including Paris, Amsterdam, Hamburg, and Vienna—sought to illuminate their streets with candles and oil lamps for the purpose of discouraging crime and social disorder.⁴² But effective lighting came only with the use of gas, which first appeared in London street lamps in 1807. Gas-lighting diffused fairly rapidly in Europe and in the United States, but not without a struggle. One argument against better illumination was that the evildoers needed light for their operations. Cautious citizens in Birmingham did not want to experiment with new lighting; they believed that the crime rate in their city was lower than London's because their city was so dark.⁴³ In 1816 a Cologne newspaper opposed gas-lighting on several grounds, one of which was that as the fear of darkness vanished, drunkenness and depravity would increase. Moreover, gaslight transgressed the laws of God and of nature: "Artificial illumination is an attempt to interfere with the divine plan of the world, which has preordained darkness during the night."⁴⁴

The city offered entertainment and high culture; it stimulated the senses and stretched consciousness in ways that the countryside could not match. We are well aware of the ancient Greeks' love of the theater, and the Roman populace's infatuation with spectacular shows. At what hours did these events occur? With few exceptions, they took place in daylight hours, or on bright, moonlit nights. Culture, like everything else, had to submit to nature's cycle. In late medieval times, performances of religious plays might start as early as 4:30 A.M. Some plays were presented in a succession of afternoons. In Spain during the sixteenth and seventeenth centuries, performances were required to end at least an hour before nightfall. This meant that in the fall and winter seasons, plays had to begin at two o'clock in the afternoon. The progressive extension of day into night is well illustrated by the changing starting time of the English theater. In the Restoration period it was 3 or 3:30 P.M.; "by 1700, it had been moved to 4 or 5; between 1700 and 1710, the time varied from 5 to 5:30 to 6; after 1710, the usual hour was 6 P.M.; by the last quarter of the eighteenth century it had become 6:15 or 6:30."⁴⁵

Electricity has made it possible for people to conquer the night, if they should so wish. Public activities need no longer be dependent on the sun. Twilight presages not withdrawal but a new burst of activity on the brilliantly lit boulevards and the "great

⁴¹ Walter Besant: *London in the Eighteenth Century* (Adam & Charles Black, London, 1903), pp. 91–93.

⁴² William T. O'Dea: *The Social History of Lighting* (Routledge & Kegan Paul, London, 1958), p. 98.

⁴³ Gill, *op. cit.* [see footnote 21 above], p. 157.

⁴⁴ M. Luckiesh: *Artificial Light: Its Influence Upon Civilization* (The Century Co., New York, 1920), p. 158.

⁴⁵ Oscar G. Brockett: *History of the Theatre* (3rd edit.; Allyn and Bacon, Boston, 1977), pp. 201 and 297.

white ways." Can any city claim cosmopolitan glamor and panache without a vigorous night life? Here is how Elizabeth Hardwick characterized Boston in the 1950's:

In Boston there is an utter absence of that wild electric beauty of New York, of the marvellous excited rush of people in taxicabs at twilight, of the great Avenues and Streets, the restaurants, theatres, bars, hotels, delicatessens, shops. In Boston the night comes down with an incredibly heavy, small-town finality. The cows come home; the chickens go to roost; the meadow is dark. Nearly every Bostonian is in his own house or in someone else's house, dining at the home board, enjoying domestic and social privacy. The "nice little dinner party"—for this the Bostonian would sell his soul.⁴⁶

Boston in the 1950's lacked glamour. What is glamour? The root meaning of the word is magic. A modern metropolis, however deficient in luster during the day hours, is transformed by the mere turn of switches into a brazen world of glittering lights after dark. People, too, discard their workaday personalities for fancier masks. In the cinemas and theaters, the inchoateness of ordinary living is forsaken for the magical clarity of the screen and stage. Night life seems unnatural. As daylight fades, so should human consciousness. In the great metropolitan centers this natural rhythm is disrupted by high culture, but even more so by its Bohemian fringe and the marginal society that maintains all-night movie houses, steam baths, and pornographic bookshops. We should remember, however, that only a small fraction of the people in a metropolis are truly night people. Most citizens, particularly workers who have to get up early in the morning, order their lives more or less by the course of the sun; and to the degree they succeed in doing so they feel virtuous.

SCALE AND VALUE

In imaginative as well as in social scientific literature the tendency to polarize "city" and "countryside" persists. Instead of such polarized categories I have suggested a scale, at one end of which lie ways of living closest to nature. The "city," then, is a broad term covering a succession of social and physical types that occupy different positions along the scale. Sociological studies have shown that in rural communities human relationships tend to be restricted to kinfolk and neighbors; by contrast, in a great metropolis people live in "a world of strangers." Recognition of a scale forces us to attend to the intermediate states between these extremes. In this paper I have chosen to focus on physical rather than on sociological criteria.⁴⁷ A city is placed according to its degree of departure from food production and the natural rhythms of life.

The question of value is held in abeyance. Is it good to live in an increasingly artificial world? Conquest of nature, even in the most advanced technological society, can seem tenuous: in winter citizens of Minneapolis are deeply aware of what a fuel crisis can mean; and twice in the last twelve years (on November 9, 1963, and on July

⁴⁶ Elizabeth Hardwick: *A View of My Own* (Noonday Press, New York, 1962), p. 150.

⁴⁷ Discussions of the rural-urban continuum follow the sociological rather than the environmental line, the latter being the one I have stressed here. See Oscar Lewis and Philip M. Hauser: *The Folk-Urban Ideal Types*, in *The Study of Urbanization* (edited by Philip M. Hauser and Leo F. Schnore; John Wiley, New York, 1965), pp. 491-517.

13, 1977) millions of New Yorkers have known how their city looks when the lights suddenly dim in their homes and on the streets because of power outages. On the scale I have proposed, modern cities are farther removed from nature than are those of the past, but to this general fact two qualifying points need to be added. One is that even in the most sophisticated metropolis of modern times only a small number of the citizenry push themselves to the limits of artifice: to those who are asleep in their homes a power failure at night is registered only by their electric clocks, but to those who stroll along Broadway, enjoying its bright lights, the sudden plunge into darkness can seem the end of the world. The other point is that the mere use of a scale and of the comparative method does not imply progressive evolution: people are not bound to subdue the night or perspire in overheated rooms in winter. It is an illusion to think that cities necessarily evolve from a state with close ties to nature to one which, like New York's Times Square or St. John's new Jerusalem, is mineralized and brightly lit, without nature's bliss of unconsciousness and the beneficence of night.

RURAL AND SMALL-TOWN DEPOPULATION IN COLOMBIA*

LYNDEN S. WILLIAMS and ERNST C. GRIFFIN

SCHOLARS concerned with demographic patterns in developing countries have focused their attention on rapid total population growth and on the explosive growth of cities. Such attention is merited. In Latin America annual growth rates of 3 percent and city growth rates of 7 percent or more have been commonplace. Rural and small-town depopulation is an obvious concomitant of rapid and continuing urbanization; the process is well known in the technologically advanced countries of the world. Nonetheless, it is widely assumed—and often stated—that rural and small-town depopulation is prevented in Latin America by extraordinarily high rates of natural population increase in rural areas.¹ This assumption is no longer valid in Colombia. Rural and small-town depopulation has been noticeable in Colombia since the 1950's, and the process appears to be accelerating.

The purpose of this article is to analyze the process of population concentration in Colombia in the last two intercensal periods, focusing primary attention on rural and small-town depopulation. We are concerned with the spatial patterns of rural and urban population change, especially the location, extent, and degree of depopulation.

DATA AND DEFINITIONS

Our study area consists of that portion of Colombia which had departmental status in 1973 (Fig. 1). The region contains about 97 percent of the population of the country. Most of the large population clusters are located within the three major mountain ranges and the Magdalena and Cauca valleys that separate them, or along

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¹ In 1967 the director of the Colombian Agrarian Reform Institute estimated that rural population increased by about a thousand families per week in spite of rural-urban migration (cited in Emil B. Haney, Jr.: *The Minifundia Dilemma: A Colombian Case Study*, in *Population Policies and Growth in Latin America* [edited by David Chaplin; Lexington Books, Lexington, Mass., 1971], pp. 265-275, reference on p. 265). In his widely cited article on urbanization, Kingsley Davis claimed that the rate of out-migration from rural areas in developing countries (with numerous examples from Latin America) is not sufficient to offset natural population increase and that "there is some doubt that it could conceivably do so" (Kingsley Davis: *The Urbanization of the Human Population*, *Sci. Amer.*, September, 1965, pp. 41-53, reference on p. 51). Also, see Harley Browning: *The Demography of the City*, in *The Urban Explosion in Latin America* (edited by Glenn Beyer; Cornell Univ. Press, Ithaca, N.Y., 1967), pp. 71-116, reference on p. 90; John D. Durand and César A. Peláez: *Patterns of Urbanization in Latin America*, in *The City in Newly Developing Countries* (edited by Gerald Breese; Prentice-Hall, Inc., Englewood Cliffs, N.J., 1969), pp. 166-188, reference on pp. 168-172; Lowdon Wingo: *Latin American Urbanization: Plan or Process*, in *Shaping an Urban Future* (edited by B. Frieden and W. Nash; M.I.T. Press, Cambridge, Mass., 1969), pp. 115-146, reference on p. 133; and Alan Gilbert: *Latin American Development: A Geographical Perspective* (Penguin Books, Harmondsworth, Middlesex, 1974), pp. 133-134. These writers are technically correct in stating that rural population growth has continued in most Latin American countries, including Colombia, in spite of urbanization. They are incorrect, at least in the case of Colombia, in the implicit or explicit assumption that rural population growth is typical in densely settled areas where land pressure is a problem.

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FIG. 1

the Caribbean coast. The study area also includes some sparsely settled "pioneer" zones along the Pacific coast, the Caribbean lowlands, the lower Magdalena-Cauca valley, and the western portion of the Llanos (referred to hereafter as the Llanos of Meta). The *intendencias* and *comisarias* (territories lacking departmental status), which constitute approximately the eastern half of the country, are excluded from the study owing to data limitations.

All population data were taken from the censuses of population of 1938, 1951, 1964, and the provisional data from the 1973 census.² The unofficial 1973 data were released without correction for an estimated 7 percent underenumeration.³ Although the underenumeration is known to have been more severe in Bogotá and the lower Magdalena valley, we have revised all data upward by 7 percent. An undercount for Bogotá is immaterial in this study because that area will fall into the category of rapid population growth in any case. The possibility of errors resulting from an underenumeration of more than 7 percent in the lower Magdalena valley will be noted where appropriate. Throughout most of the study area the upward revision by 7 percent probably overestimates the 1973 population and therefore understates the true extent and degree of depopulation between 1964 and 1973.

Unfortunately, the possibility of major error in census data cannot be ignored. One can reasonably expect each census to be a more accurate count of the population than previous censuses on the grounds that techniques are improving. To the extent that each census enumerates people missed by previous counts, our findings will understate the true degree and extent of depopulation. On the other hand, reports of undercounting, especially in the case of the 1973 census, are widely circulated in Colombia. We suggest that some of the more exaggerated complaints are politically motivated, stemming from the fact that federal support to local governments is determined in part by the population count.

Although concern over the accuracy of Colombian census data may be merited, we believe the use of those data is necessary and justifiable. No alternative source of data exists. In any case, the generalized patterns of rural and small-town depopulation noted in this paper will be substantially valid even if the degree of error in the various censuses is relatively large.

The accuracy achieved in describing changes in the spatial patterns of population depends partly on the relative size, and the comparability through time, of the areal units studied. The smaller the areal unit the greater the likelihood that population transfers will be between, rather than within, units and that population declines in one place will not be offset by increases elsewhere in the same unit. The *municipio* level is chosen in this study because it is the smallest areal unit for which data are consistently available. Since *municipios* are not uniform in size the study will tend to discriminate population changes more carefully in areas where *municipios* are small than in areas where they are relatively large. This spatial bias is somewhat compensated by the fact that larger *municipios* tend to be relatively sparsely settled.

² "XI Censo nacional de población: 1938, resúmenes por departamento" (Departamento Administrativo Nacional de Estadística, Bogotá, 1942); "XII Censo nacional de población: 1951, resúmenes por departamento" (Departamento Administrativo Nacional de Estadística, Bogotá, 1954); "XIII Censo nacional de población: 1964, resúmenes por departamento" (Departamento Administrativo Nacional de Estadística, Bogotá, 1967); and "XIV Censo nacional de población y III de vivienda: resultados provisionales," *Bol. Mensual de Estadística*, No. 279, Departamento Administrativo Nacional de Estadística, Bogotá, 1974, pp. 7-40.

³ XIV Censo nacional [see footnote 2 above], pp. 5 and 9.

The census provides municipio-level population data for *cabeceras* (municipio capitals) and *restos* (other than municipio capitals), and for "urban" (population in centers with 1,500 inhabitants or more) and "rural" (population in smaller centers and rural areas). We reject the use of the official urban/rural classification because the information is not available in the provisional 1973 data and because the population minimum criterion results in an arbitrary transfer of population from rural to urban status when a town surpasses the minimum population value in an intercensal period. As an alternative to the official urban/rural definition, we have labeled *cabeceras* as urban and *restos* as rural. This administrative definition of urban/rural offers several advantages. First, data are available in that form for all census periods, including the provisional 1973 data. Second, we are particularly interested in population changes in smaller towns, many of which are *cabeceras* but do not meet the population minimum for official urban classification. Third, because *cabeceras* are easily identified and located, centers that constitute the urban population can be made comparable for all census periods.

A problem of comparability arises from the creation of new municipios between census enumerations. A new municipio, containing both *cabecera* and *resto*, is carved out of the *resto* of an existing municipio. The consequent reduction in the *resto* population of the original municipio gives a misleading impression of rural depopulation. Likewise, the reclassification of a *resto* town as a *cabecera* tends to exaggerate rural population decline and urban population growth. In order to maintain comparable areal units for all three census periods, and to eliminate the bias toward rural population decline inherent in the creation of new municipios, we selected the 855 municipios that existed in 1964 as the areal units for study. Municipios created after 1964 are reconstituted back into their previous boundaries, and their *cabecera* and *resto* populations are added to the *resto* population of the original unit. Although many *cabeceras* of these newly created municipios had populations sufficiently large in 1973 to warrant an urban classification, maintaining them in the rural category is in keeping with our intent of presenting a conservative estimate of rural depopulation.

Similar logic could have been used to solve the problem of municipios created between 1951 and 1964; that is, we could have amalgamated municipios back to their 1951 boundaries and considered only 1951 *cabeceras* as urban. This solution was rejected because *cabeceras* of many municipios created before the 1964 census have grown far too large to be justifiably considered as rural. As an alternative, we have attempted to estimate the 1951 *cabecera* and *resto* populations of municipios created between 1951 and 1964, removing that value from the *resto* population of the municipios that were subdivided. The following procedure was used. First, a municipio created between 1951 and 1964 was assigned a share of the 1951 population of the original municipio that is equal to the share it had in 1964. This prevents the original municipio from appearing to have lost rural population. Second, the value added to the new municipio was divided between *cabecera* and *resto* according to the 1964 ratio. This prevents the new municipio from appearing to have lost rural population when the *resto* town is reclassified as a *cabecera*. The arbitrary 1964 ratio between *resto* and *cabecera* should provide an underestimate of the true *resto* population (owing to the generally more rapid growth of towns) in 1951 and thus should understate possible rural declines that followed. Once again, the purpose is to provide a conservative estimate of rural depopulation.

OVERVIEW OF POPULATION GROWTH, 1938 TO 1973

The most salient feature of Colombian demography is the explosive growth of urban populations. Between 1938 and 1973 the proportion of the total population living in urban areas (cabeceras) increased from 31 to 61 percent. Occurring as it did during a time of rapid total population growth, that percentage increase represents a fivefold absolute increase in urban population (Table I). Meanwhile, rural areas

TABLE I—POPULATION GROWTH IN COLOMBIA, 1938 TO 1973

	POPULATION (in thousands)				AVERAGE ANNUAL RATE OF GROWTH (in percentages)		
	1938	1951	1964	1973 ^a	1938-1951	1951-1964	1964-1973
Rural	6,010	7,080	8,391	8,798	1.27	1.32	0.53
Urban	2,692	4,468	9,093	13,747	3.97	5.62	4.70
TOTAL	8,702	11,548	17,485	22,545	2.20	3.24	2.86

Sources: XI Censo nacional, XII Censo nacional, XIII Censo nacional, and XIV Censo nacional [see text footnote 2].

^a Provisional 1973 data are adjusted upward by 7 percent to allow for estimated underenumeration.

(restos) experienced a modest increase of about 40 percent. Between 1938 and 1951 the rate of population growth in rural Colombia was less than a third that of urban Colombia; in the 1951-1964 period the total population growth rate jumped a full percentage point and yet rural areas continued to grow at a rate only slightly above that of the previous intercensal period. Between 1964 and 1973 there was a modest decline in the total rate of population growth, and rural growth was cut to almost zero. The population explosion of Colombia has thus affected primarily, and more recently almost totally, urban areas.

The rural growth rate of Colombia between 1964 and 1973 could suggest a demographically stagnant region with high death rates and/or low birthrates. This is emphatically not the case. The age-specific birth and death rates of rural Colombia are consistent with extremely rapid population growth; the massive out-migration of young people from rural areas has artificially lowered birthrates, has increased death rates, and has removed population in absolute terms. Those who suggest that the urban explosion in Latin America is primarily the result of natural increase rather than rural-urban migration miss the crucial point that migration produces an age structure favorable to population growth in the destination area and unfavorable to growth in the area of origin. Because the total fertility rate exceeds two children per female, the children born in cities to age-selected migrants tend to swell urban populations more than do the migrants themselves (and, it should be noted, reduce rural populations by similar amounts).⁴

⁴ Numerous writers have attempted to underrate the importance of migration as a cause for urban population growth. They are able to demonstrate that most urban population growth is made up of persons born in the cities. For example, in reference to Costa Rica, Kingsley Davis (*op. cit.* [see footnote 1 above], p. 50) stated that between 1927 and 1963 the proportion of the population in urban areas increased from 18.8 to 34.5 percent; if the total population had remained at the 1927 level (471,500), that percentage increase would have raised urban populations from 88,600 to only 162,700. Since the actual urban population in 1963 was 456,600, Davis calculated that only 20 percent of the increase was a result of urbanization per se; and based

National average rates of population growth mask great interregional variations. In order to gain a general impression of variations in rates of population growth in Colombia, we divided municipios in the study area into three groups: municipios with growth rates that exceeded the national average rate (51.4 percent between 1951 and 1964 and 28.9 percent between 1964 and 1973); municipios with positive rates of growth that are lower than the national average rate; and municipios that lost population. In the 1951-1964 period municipios with rates of population growth above the national average covered more than half of the study area (Fig. 2); if the eastern half of the country were included in the study the percentage would have been far higher. Almost all of the municipios that contained large cities fell into this category. The exceptions tended to have large depopulating rural sectors that partially offset urban increases. Many of the lowland portions of the study area also experienced rapid population growth: most of the Llanos of Meta, the lower Magdalena and Cauca valleys, parts of the Caribbean lowlands, and the Pacific littoral. Municipios in which population declined tended to be confined to highland zones, especially the Cordillera Oriental, and constituted a rather small portion of the total study area. Slow population growth was characteristic throughout the highland zones and not uncommon in coastal areas.

In the 1964-1973 period a far smaller proportion of the total area fell into the rapid growth category (Fig. 3). Several municipios containing large urban centers had slow population growth, or even lost population. Similarly, many lowland areas experienced low rates of growth or depopulation. The slow growth and depopulation shown in the lower Magdalena valley may reflect underenumeration in 1973. However, depopulating and slowly growing municipios are far too numerous to be accounted for by consistent undercounting throughout the country. Municipio population decline was commonplace throughout the densely settled central highlands and occurred in many other areas as well. Significantly, population decreased in some areas that are usually considered to be pioneer zones (parts of the Llanos of Meta, the Caribbean lowlands, and the Pacific littoral).

Figures 2 and 3 illustrate some of the dangers of using national averages to describe population change within a country. As the maps reveal, population growth is highly concentrated and the tendency is for an ever-smaller share of the total area to receive an ever-increasing share of the total growth. It is commonplace to consider national average rates of population growth as indicators of the relative rates of change in population pressure, labor supply, the man/resource balance, and so forth, between countries. The validity of the comparisons rests on the assumption that regional variations in growth rates within countries do not exceed variations between them, or that the national average rates of growth reflect conditions throughout most of the

on the apparent assumption that the 1927 urban population would have maintained a growth rate equal to the national average rate, he calculated that 44 percent of the increase resulted from the natural increase of the population already in cities. We argue that the 1927 urban population probably did not maintain a growth rate equal to the national average rate; but even if we accept Davis's figures, an additional 36 percent of the urban population growth must still be accounted for by the offspring of migrants, or a total of 56 percent resulting directly or indirectly from migration. Even the 75,000 migrants (implied in Davis's simulation), which constituted less than 9 percent of the 1963 rural population, could easily have swelled urban population by 200,000 between 1927 and 1963 and, because of the potentially higher rural fertility, could have reduced rural population by an even greater amount. The percentage of the urban population born in rural areas is an invalid measure of rural-urban migration. Since the young migrants tend to have two or more children after arriving in the city, and survive to see their grandchildren born there as well, migrants are not likely to constitute a very large percentage of their own progeny born in the city, let alone the total city population.

various countries. This is not the case. In Colombia a majority of the municipios experienced rates of population growth in the 1964-1973 period that were either above El Salvador's high of 3.5 percent annually, or below Uruguay's low of 1.2 percent, for Latin America. National averages tell us little about growth rates at the scale where questions of population pressure and labor supply are significant.

RURAL AND CABECERA POPULATION CHANGE

To understand the true spatial extent of depopulation it is necessary to exclude population growth in that small fraction of the total area that makes up the towns and cities of the country so that changes in rural areas can be examined. We propose a regional classification for rural (restos) population change by municipio: 1) rural population growth above the national average rate; 2) rural population growth, but at a rate below the national average; and 3) rural population decline. Similarly, we classify cabeceras into three groups: 1) cabecera population growth above the national average rate; 2) cabecera population growth, but at a rate below the national average; and 3) cabecera population decline.⁵

An advantage of the proposed classification is that each class implies specific characteristics regarding the causes and consequences of population concentration. The Class 1 rural region and cabeceras can be assumed to be experiencing positive net migration; obviously, population growth above the national average rate can be achieved without positive net migration, but the number of cases in which it is solely through higher natural increase (aside from the indirect effects of age-selective migration on birthrates) is probably trivial. The Class 2 rural region and cabeceras are almost certainly losing population in the migration process, but the rate is insufficient to reduce local population in absolute terms. The Class 3 rural region and cabeceras are sustaining rates of emigration sufficient to offset natural population increase; again, a population loss resulting solely from low fertility rates and high death rates (aside from age-structure changes through past migration) is probably rare in Colombia.

The consequences of population concentration are too vast to receive more than rudimentary treatment here. We will confine our remarks to the impact on land pressure and labor supply and future population growth rates. The Class 1 rural region and cabeceras are experiencing a massive increase in labor supply. Migration theory suggests that immigrants tend to be young and relatively skilled; moreover, continued rapid population growth is virtually assured in the short run through offspring of the young immigrants. On the other hand, as the percentage of the total population in urban areas increases, the generally lower age-specific fertility in urban

⁵ This classification is analogous to the theoretical model of population concentration introduced by Jack Gibbs in which five stages are hypothesized: 1) the rate of rural population growth exceeds the urban rate; 2) rural growth takes place, but at a lower rate than urban growth; 3) urban growth continues while rural population undergoes an absolute decline; 4) large cities grow while rural and small-town populations undergo an absolute decline; and 5) large-city populations decline while rural and small-town populations grow anew, producing a more even distribution of population (Jack R. Gibbs: *The Evolution of Population Concentration*, *Econ. Geogr.*, Vol. 39, 1962, pp. 119-129). Although Gibbs did not expect the stages to be necessarily mutually exclusive or inevitable, he did hypothesize that the stages would tend to evolve in sequence. We do not rule out the possibility that population concentration tends to occur in an evolutionary sequence as suggested by Gibbs. However, we believe that the spatial context is a more revealing measure of the process of population concentration than the temporal context. In order to understand the trends of depopulation (or population concentration) it is necessary to examine the extent, degree, and location of its occurrence, and this is best accomplished by aggregating the smallest areal units possible into regions of similar growth characteristics.

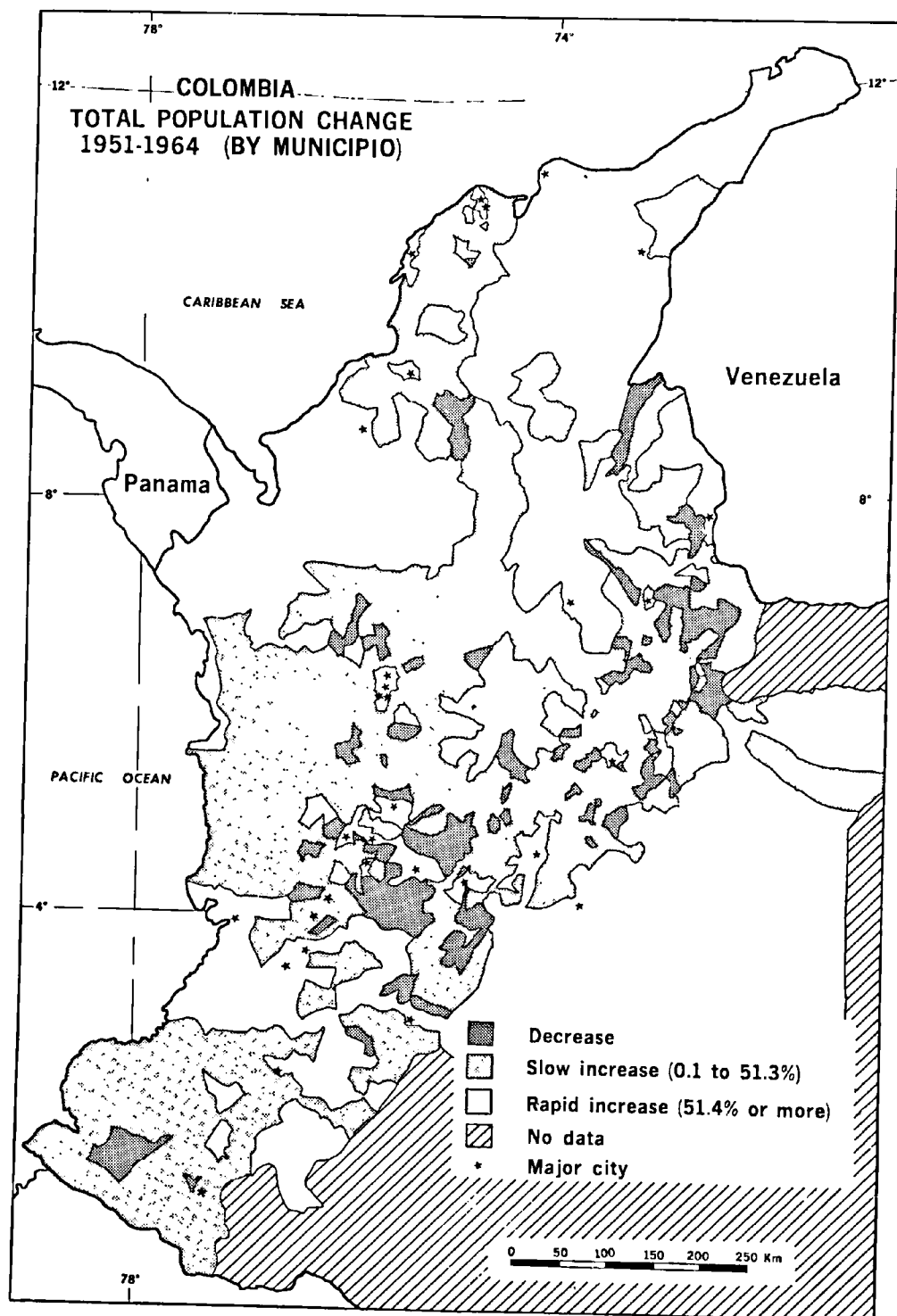


FIG. 2—Distribution of municipalities by rates of population change between 1951 and 1964. Sources: XII Censo nacional and XIII Censo nacional [see text footnote 2].

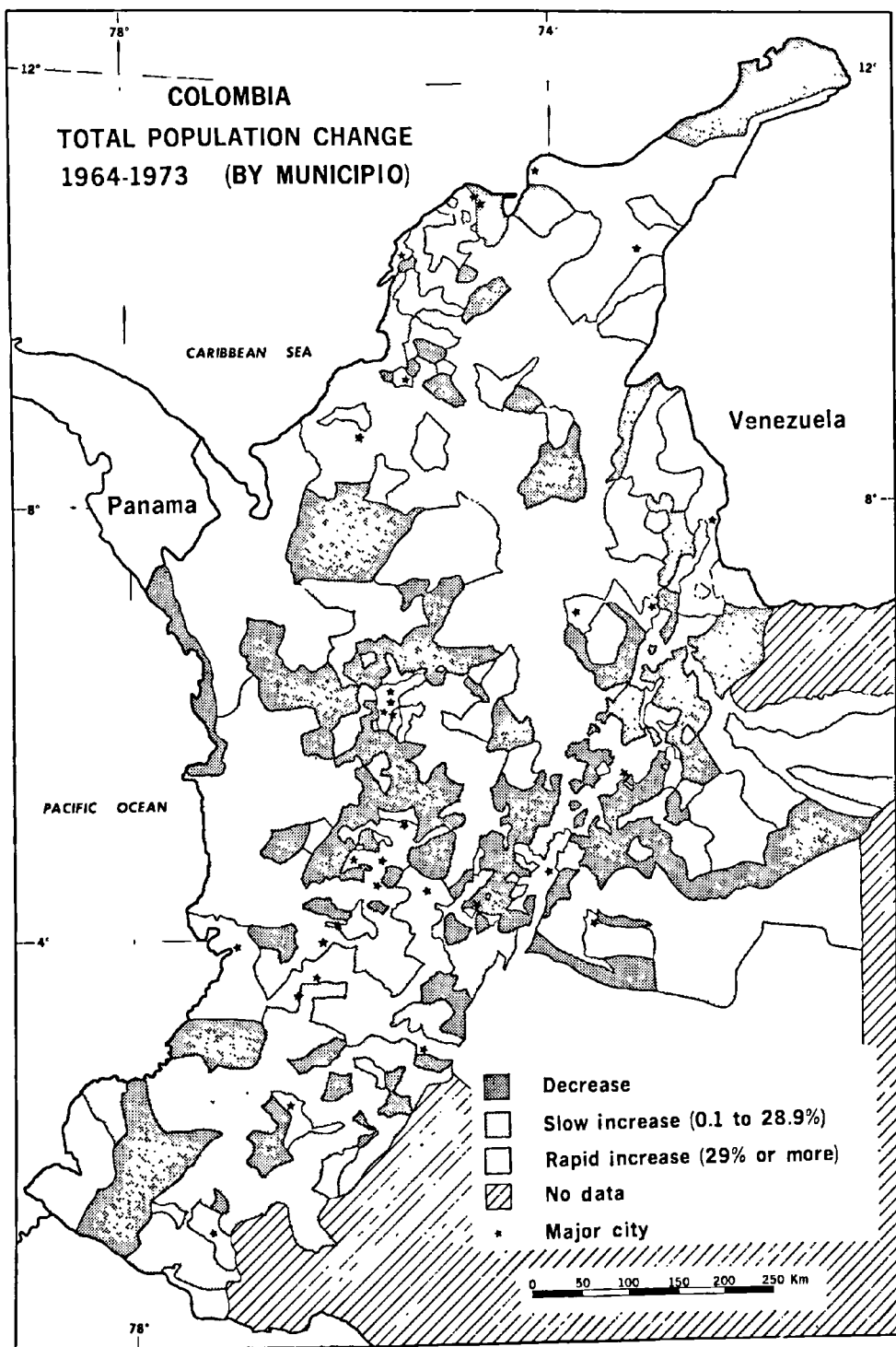


FIG. 3—Distribution of municipios by rates of population change between 1964 and 1973. Sources: XIII Censo nacional and XIV Censo nacional [see text footnote 2].

TABLE II—MUNICIPIOS, AREA, AND POPULATION BY RATE OF POPULATION CHANGE IN THE 1951-1964 AND 1964-1973 INTERCENSAL PERIODS IN THE COLOMBIA STUDY AREA*

	MUNICIPIOS				POPULATION				NET POPULATION CHANGE			
	Number		Percentage		Area ^a (in percentages)		Number (in thousands)		Percentage		Number (in thousands)	
	1951- 1964	1964- 1973	1951- 1964	1964- 1973	1951- 1964	1964- 1973	1951- 1964	1964- 1973	1951- 1964	1964- 1973	1951- 1964	1964- 1973
	1951- 1964	1964- 1973	1951- 1964	1964- 1973	1951- 1964	1964- 1973	1951- 1964	1964- 1973	1951- 1964	1964- 1973	1951- 1964	1964- 1973
<i>Rural region</i>												
Region 1: Rapid increase	172	112	20.1	13.1	49.5	26.3	2,033	1,667	11.8	7.6	1,093	713
Region 2: Slow increase	483	342	56.5	40.0	37.3	38.1	4,047	3,694	27.0	16.8	726	395
Region 3: Decrease	200	401	23.4	46.9	13.2	35.6	1,502	3,258	8.7	14.8	-353	-671
ALL RURAL AREAS	855	855	100.0	100.0	100.0	100.0	8,182	8,619	47.5	39.2	1,468	437
<i>Cabeceras group</i>												
Group 1: Rapid increase	418	372	48.9	43.4	...	...	7,927	10,868	46.1	49.4	4,292	4,088
Group 2: Slow increase	382	369	44.7	43.2	...	...	1,036	2,163	6.0	9.8	241	314
Group 3: Decrease	55	114	6.4	13.4	...	...	63	362	0.4	1.6	-62	-36
ALL CABECERAS	855	855	100.0	100.0	...	...	9,026	13,393	53.5	60.8	4,471	4,366
TOTAL	...	...	...	...	...	...	17,208	22,012	100.0	100.0	5,937	4,803

Sources: Calculated by the authors from XII Censo nacional, XIII Censo nacional, and XIV Censo nacional [see text footnote 2]. The figures are based on the study area only and therefore differ slightly from country totals.

* All 1973 figures include a 7 percent upward adjustment for underenumeration.

^a The area of cabeceras is included in rural regions.

areas should eventually act to reduce the overall rate of population growth of the country. We are unable to determine whether the rapid population growth in the Class 1 rural region is a result of an increase in the agricultural population or an increase in the suburban and nonfarm population beyond legal city boundaries. It is probably safe to assume that near large cities rapid population growth is partly or mostly an increase in the rural nonfarm population, whereas growth in sparsely settled areas is agricultural, perhaps in the nature of pioneer settlements.

The Class 2 rural region and cabeceras probably have the most critical population pressure and growth problems. These areas are probably sufficiently depressed economically to encourage the emigration of many young and skilled persons, but the rate of emigration is insufficient to reduce population pressure in absolute terms. Since the population is increasing, the future supply of emigrants appears to be unending.

If emigration is a solution to population pressure, the Class 3 rural region and cabeceras are beneficiaries of the process. The absolute decline in the population could improve the man/resource balance, and negative net migration must ultimately slow and end. On the other hand, population decline would not guarantee better access to resources for those remaining, and the "brain drain" theory of emigration suggests that the remaining population would be less apt to seize opportunities that might become available. If emigration is too rapid, removing most of the young people, then low crude birthrates and high crude death rates may diminish population below the level needed to maintain a viable economy.

RURAL AND SMALL-TOWN DEPOPULATION

In the 1951-1964 period almost a quarter of the municipios in the study area experienced rural depopulation (Table II). An absolute decline of about 350,000 persons greatly understates the actual transfer of population from this region. If we assume that the population growth rate would have equaled the national average rate in the absence of emigration, it follows that the 1951 population of 1,850,000 would have increased to about 2,800,000 by 1964. The actual 1964 population of 1,500,000 therefore suggests a net transfer of 1,300,000 people out of the Class 3 rural region as a direct and indirect result of migration.

More than half of the municipios in the study area experienced rural population growth at a rate below the national average. If the 1951 population of almost 4 million in the Class 2 rural region had increased at the national average rate between 1951 and 1964 they would have numbered about 6 million by 1964. This implies a net transfer of some 1,300,000 persons from rural areas with slow population growth.

A net transfer of 2,600,000 persons from depopulating and slowly growing rural areas to the Class 1 rural region and cabeceras would not require a migration of that magnitude. A large share of the net transfer is the result of the birth of the migrants' offspring in the destination area rather than in the area of origin. It is also obvious that the figure presented will not include some forms of migration; emigration is partially offset by immigration, and there must be a considerable movement of people within each of the regions and groups shown in Table II.

Slow rural growth or depopulation was characteristic throughout most of highland Colombia in the 1951-1964 intercensal period (Fig. 4). Almost all of the Cordillera Oriental was included in the Class 2 and 3 rural regions. Rural population growth

was also slow or absent in parts of the Caribbean lowlands and the Pacific littoral. The slowly growing and depopulating rural regions contained 75 percent of the rural population but covered only about half of the total study area. In general these regions are made up of the smaller, more densely settled municipios.

A relatively small number of cabeceras experienced population declines in the 1951-1964 period. Most of these Class 3 cabeceras were small towns and villages (averaging about a thousand inhabitants each) and in total accounted for less than half of 1 percent of the 1964 population (Table II). If the 1951 population of about 125,000 had increased at the national average rate, these cabeceras would have contained about 190,000 inhabitants in 1964. The actual 1964 population of 63,000 implies a net transfer of about 125,000 persons. Once again, it is obvious that these towns could not have generated 125,000 emigrants (a number approximately equal to the 1951 total population). Indeed, age-selective migration before 1951 may have produced an age structure in which high death rates (among a high percentage of the population in older age groups) would more than offset the birthrate, resulting in population loss without emigration. The negative impact on population growth of age-selective migration will continue for many decades after the actual migration has occurred, as will the positive impact in the destination area.

The distribution of towns and villages experiencing depopulation during the 1951-1964 period conforms in general to that of rural depopulation. With a few exceptions, these cabeceras are located in the densely settled highlands, mostly in the Cordillera Oriental.

A much larger number of cabeceras experienced population growth at rates below the national average between 1951 and 1964 (Table II). These Class 2 cabeceras also tended to be relatively smaller towns and villages and accounted for only about 6 percent of the 1964 population. The figures imply a net transfer of about 170,000 persons out of these slowly growing towns and villages.

In the 1964-1973 intercensal period the number of municipios with depopulating rural sectors was double that of the previous intercensal period and included almost 47 percent of all municipios in the study area (Table II). The absolute decline of about 670,000 persons considerably understates the impact of emigration from this region. Population growth at the national average rate would have increased the 1964 population of about 4 million to more than 5 million by 1973; the actual 1964 population of about 3,250,000 suggests a net transfer of about 1,800,000 persons to other areas.

Another 40 percent of the municipios had rates of rural population growth below the national average rate. The 3,300,000 people in the Class 2 rural region would have numbered 4,250,000 if they had increased at the national average rate; the actual population of about 3,700,000 suggests a net transfer of more than half a million persons to other areas.

The distribution of the Class 2 and 3 rural regions between 1964 and 1973 was more varied, as well as more extensive, than during the previous intercensal period (Fig. 5). As had been true previously, slow growth or depopulation was common throughout the densely settled highlands. Perhaps most striking was the depopulation in many lowland zones. Depopulation was characteristic along the Pacific coast and was widespread in the Caribbean lowlands and the Llanos of Meta. The apparent change from rapid population growth to depopulation in the lower Magdalena valley may reflect census underenumeration, as we noted above. However, even if we assume that

underenumeration was considerably greater than hypothesized throughout the country, depopulation and slow growth would appear to have been the dominant demographic pattern in rural Colombia.

The number of cabeceras undergoing absolute decreases in population also doubled during the latter intercensal period. As had been true in the previous period, depopulating cabeceras tended to be smaller towns and villages, and the total population loss was slight. The distribution of these towns and villages was similar to that of the previous period; most were in the highland zones and many in the Cordillera Oriental (Fig. 5). Cabeceras with slow rates of population growth between 1964 and 1973 were also relatively smaller towns and maintained rates of growth that imply a rather minor transfer of population to other areas. Taken together, the depopulating and slowly growing towns and villages had about 350,000 fewer inhabitants than they would have if their rates of population growth had equaled the national average.

A transfer of 2,600,000 people from slowly growing and depopulating rural areas between 1951 and 1964 and of 2,300,000 from those areas between 1964 and 1973 would produce an annual rate of about 200,000 during the earlier period and 250,000 in the later. Thus, the rate of transfer appears to be increasing significantly. From the rural sector as a whole the annual rate was about 150,000 between 1951 and 1964 and about 200,000 in the 1964-1973 period; rapidly growing rural areas picked up about 50,000 persons annually in both periods. These estimates include both the absolute population loss through emigration and the impact of lower birthrates resulting from age structure changes owing to emigration; the actual number of emigrants would presumably have been much lower.

By way of comparison, Dale Adams estimated that the annual rate of rural-urban migration in 1967 was about 200,000.⁶ Our estimate is considerably lower than Adams's, for we have included in our figures both the movement of people *per se* and the indirect effects of migration on birthrates. Our lower estimate probably results in part from our more restricted definition of the rural population. The slowly growing and depopulating cabeceras were mostly small towns and villages that fall into the rural category by the official definition; these cabeceras lost approximately 25,000 annually in the 1951-1964 period and approximately 40,000 annually in the 1964-1973 period. In addition, our low estimates probably reflect the intentionally conservative methodology used in this study as a hedge against possible census error. We assumed an underenumeration of 7 percent throughout the country in the 1973 census; we were careful to avoid "definitional" transfers of population from rural to urban through the creation of new municipios and cabeceras; and our assumption that rural population growth in the absence of emigration would be equal to the national average is conservative, since age-specific fertility is known to be higher in rural areas. Nevertheless, in view of the potential for census error, we believe our intentional error on the side of understatement is appropriate.

POPULATION CONCENTRATION

The degree and pace of population concentration in Colombia can be appreciated by examining population change in the rapidly growing cabeceras. In the 1951-1964

⁶ Dale Adams: *Rural Migrants and Agricultural Development in Colombia* (paper presented at the 13th Conference of the International Association of Agricultural Economists, Sydney, Australia, August, 1967).

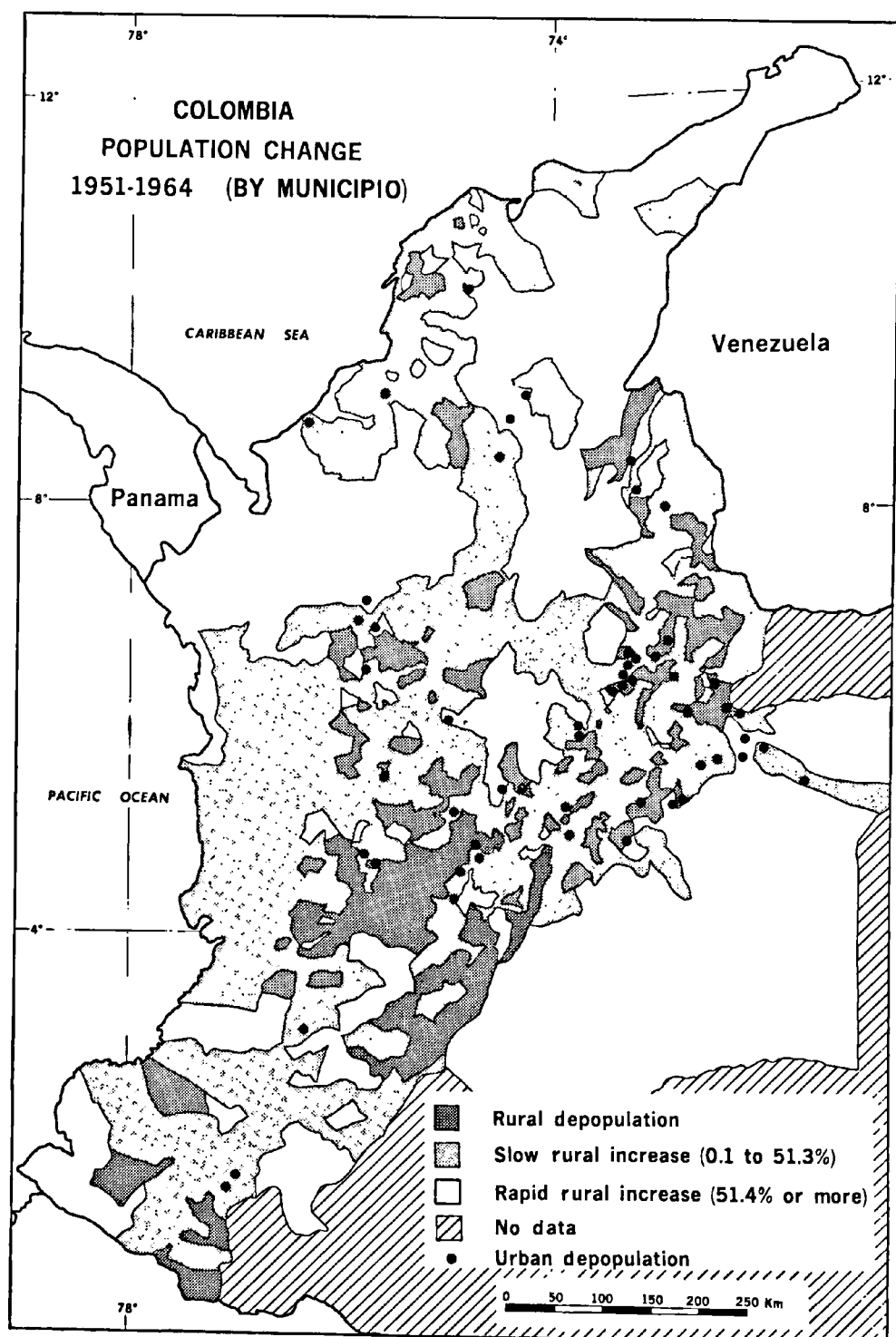


FIG. 4 - Depopulating cabeceras, and municipios with depopulating or slowly growing rural sectors in the 1951-1964 intercensal period. Sources: XII Censo nacional and XIII Censo nacional [see text footnote 2].

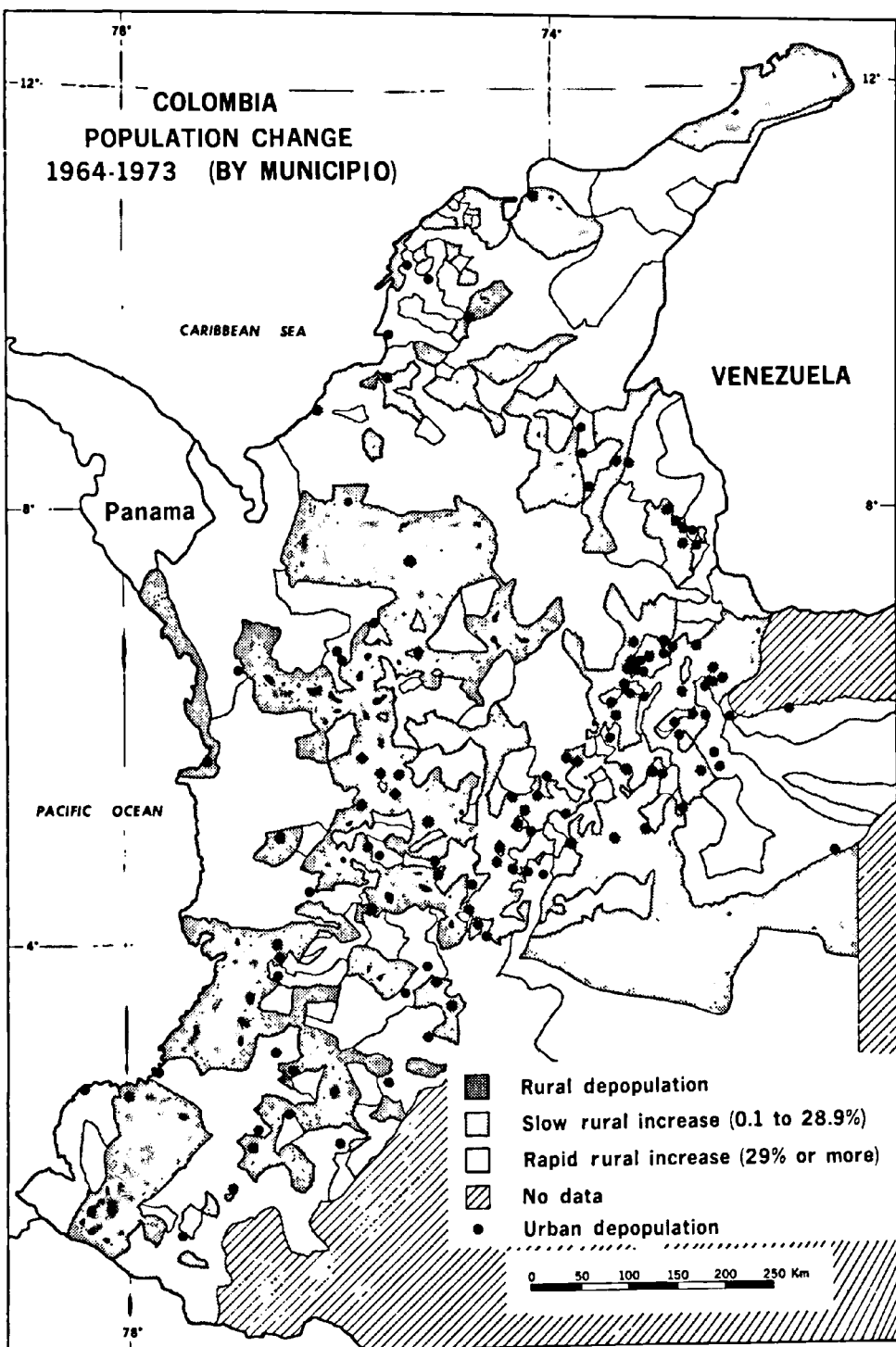


FIG. 5—Depopulating cabeceras, and municipios with depopulating or slowly growing rural sectors, in the 1964–1973 intercensal period. *Sources:* XIII Censo nacional and XIV Censo nacional [see text footnote 2].

period almost half of the cabeceras in the study area experienced population growth at a rate higher than the national average (Table II). These rapidly growing urban centers accounted for approximately 72 percent of the net population increase in that period, and by 1964 they contained about 46 percent of the total population. Significantly, the number of urban centers falling into the Class 1 cabecera group decreased in the 1964-1973 period, but this smaller number of cabeceras contained almost half of the total 1973 population and accounted for approximately 85 percent of the net population increase in that period. Bogotá alone has captured a large and growing share of the net population growth in Colombia. In the 1938-1951 period Bogotá accounted for about 12 percent of the net increase in the study area. The figures for the 1951-1964 and 1964-1973 periods were about 17 percent and 25 percent, respectively. The next five largest cities in Colombia (after Bogotá) together captured an additional 20, 20, and 25 percent of the net population increase during the three intercensal periods.⁷

The Class 1 cabeceras were spread throughout the study area. Most notably, they included all the major cities shown in Figure 2 in the 1951-1964 period and all but six in the subsequent period.

About 20 percent of the municipios experienced rapid rural population growth in the 1951-1964 period. These municipios tended to be relatively large and sparsely settled; they covered almost half of the total area but contained only about 12 percent of the total population in 1964 (Table II). In the subsequent intercensal period the region of rapid rural growth was much reduced, and it contained only about 8 percent of the total population in 1973.

There were two major changes in the spatial pattern of the Class 1 rural region between the 1951-1964 and the 1964-1973 periods. First, many sparsely settled lowland areas that had been included in the rapid growth region in the earlier period experienced slow growth or depopulation in the later period. The areas along the Pacific coast, in the Caribbean lowlands, and the Llanos of Meta are usually thought of as pioneer zones. The decline in the rate of population growth in many of these areas leads us to speculate that colonization activities have abated considerably or perhaps are focused on more remote areas that are excluded from the study area. Second, in the later intercensal period rapid rural growth occurred in and near many municipios that contain large urban centers. Most notable were areas near Bogotá, Cali, and Santa Marta. This growth was conspicuously absent in the 1951-1964 period. It seems likely that rural population growth around major cities marks a trend toward urban sprawl in Colombia.

SUMMARY AND IMPLICATIONS

Colombia's rural population has continued to increase during the past three decades in spite of rapid urbanization and the explosive population growth in cities. In this regard Colombia is similar to most other countries in Latin America.⁸ Continued rural population growth has led numerous observers to conclude that current demographic patterns in Latin America differ significantly from the historical patterns of the United States and other technologically advanced countries, where

⁷ In order to maintain consistency, these figures are calculated for net population increases in the study area and therefore differ slightly from net population increases for the entire country.

⁸ Durand and Peláez, *op. cit.* [see footnote 1 above].

later stages of urbanization have been accompanied by an absolute decline in the agricultural population. These writers foresee ominous economic and demographic consequences for Latin America. Continued rural population growth will tend to exacerbate economic problems in areas where land pressure and underemployment are already severe. Perhaps even more critical, the high fertility rate of a growing rural population portends an unending supply of future migrants to the already overburdened cities.

We have shown that rural population growth has not been typical of most of the densely settled agricultural areas of Colombia. If the pioneer zones within the study area had been excluded from the calculations the net population change in rural Colombia would have been negative in the 1964-1973 intercensal period. Moreover, an unknown portion of rural population growth must be due to suburbanization beyond legal city boundaries and to growth of rural nonfarm population. Confirmation of an absolute decline in the agricultural population will have to await release of the full 1973 census; nonetheless, the provisional population data strongly suggest that a significant decline has taken place in the densely settled highland regions.

The phenomenon of rural depopulation goes back at least to the 1950's. In the earlier intercensal period rural depopulation occurred in fewer municipios, affected a smaller percentage of the total rural population, and the negative change was slight. Nevertheless, the spatial pattern of rural depopulation during that period was consistent with the much stronger trend that followed.

Small-town depopulation was slight during both intercensal periods studied. Because most of the depopulating towns were very small, it might be more accurate to characterize this as a part of rural depopulation. On the other hand, a significant number of towns experienced population growth at rates far below the national average rate. This suggests that small towns are an important source region for cityward migration, or more likely, that the immigration to small towns from rural areas is insufficient to offset the emigration to larger towns and cities.

The occurrence of slow population growth and depopulation in rural Colombia, is, in many ways, a favorable demographic trend. There may be some progress toward achieving a better balance between the population and the resource base. A continuation of the rural depopulation trend would assure an eventual end to the flood of migrants to urban areas. The increase in the proportion of the total population in urban areas, where fertility rates are lower, probably accounts for the decrease in the rate of population growth in Colombia in the last intercensal period. A continuation of the urbanization process is probably the best hope for bringing the population growth rate under control.

We do not wish to suggest that the agrarian and demographic problems of Colombia are abating. At best rural depopulation is a mixed blessing. It is possible that part of the migration out of rural areas is an act of desperation made increasingly necessary by the introduction of labor-saving farm machinery. More likely, emigration acts as a "brain drain" on rural areas. Migration theory suggests that these areas are characterized by high dependency ratios and high crude death rates, having lost many of their more capable and energetic inhabitants. The concept of the hollow frontier sees rural depopulation in pioneer zones as an undesirable consequence of land tenure and utilization; pioneers who practice intensive farming may push progressively toward the frontier, using virgin land, while land previously farmed is given over to cattle ranching. Rural depopulation in parts of the Llanos of Meta and

other presumed pioneer zones in the 1964-1973 period suggests that the hollow frontier concept may be applicable in that area.

We do not know whether rural depopulation has led to the release of agricultural land, or if it has, whether that land is available to landless or land-poor farmers. If abandoned land is incorporated into large estates, then (given the propensity of estate owners to cultivate only a fraction of available land and to accomplish that with labor-saving machinery) the total output and employment in depopulating areas may be decreasing. This study provides no support whatever to the contention that land redistribution is no longer necessary. At best, it will take massive depopulation in many traditional farming areas in the highland to reduce land pressure and raise productivity sufficiently to provide a reasonable standard of living for the majority of the people.

Almost a decade ago Harley Browning stated that the time when the agricultural labor force undergoes an absolute, rather than relative, decline is the date that signals a major transformation or turning point in a country's economic development.⁹ Colombia is now approaching that point. Further research is needed to determine whether rural depopulation is having the desired effect in Colombia, and whether that country is unique among Latin American countries in this demographic trend.

⁹ Browning, *op. cit.* [see footnote 1 above], p. 90.

AFRICAN POLITICS AND PORT EXPANSION AT DAR ES SALAAM*

B. S. HOYLE

POLITICS and transportation are closely intertwined in modern Africa. Studies of Third World development normally recognize the all-pervading importance of the political dimension; the significance of the chronological perspective in political development has frequently been demonstrated. Numerous writers have analyzed geopolitical situations on a macro scale;¹ however, fewer attempts have been made to analyze micro-scale political situations in spatial terms. Balancing international trends in commodity flows and transport technology with national and regional political and economic systems is a fundamental dilemma of port authorities in modern Africa, and the role of the seaport is critical in solving this problem.² As a vital node in a complex and rapidly changing international system, a seaport must respond promptly and efficiently to change. During the period from 1965 to 1975, the port of Dar es Salaam did respond, and its transformation marked the beginning of a new era in the development of the port and of Tanzania.

POSTCOLONIAL CHANGES

Economic and political changes and developments in eastern and southern Africa in the post-1960 period have involved substantial modifications and innovations in the land and sea transport systems that serve the area (Fig. 1). The achievement of political independence in Tanganyika (1961), Uganda (1962), Kenya (1963), Malawi (1964), Zambia (1964), and Mozambique (1975) has introduced new influences and controls into an already complex transport infrastructure and has repeatedly called into question the degree to which transport systems inherited from, and designed to serve, colonially devised economic and political structures are appropriate in the service of the new nations of modern Africa. East Africa is served by five major ports handling ocean-going vessels. Mombasa (Kenya) is the primate port of the entire region, and Dar es Salaam is the principal Tanzanian terminal. Smaller but significant ports are Tanga, Mtwara, and Zanzibar.

The problems of adaptation to a new politicoeconomic environment were thrown into sharper focus by Rhodesia's illegal and unilateral declaration of independence in 1965. Since that date, given the progressive southward movement of the color curtain

* I acknowledge with grateful thanks financial support from the Nuffield Foundation and from the Social Science Research Council which facilitated visits to East Africa in 1973 and 1975. Data were kindly provided by numerous individuals, chief of whom were the Public Relations Manager, East African Harbours Corporation, Dar es Salaam; and the Technical Consultant, East African Cargo Handling Services Ltd., Mombasa. Illustrations were prepared in the Cartographic Unit, University of Southampton, under the direction of Alan S. Burn.

¹ See for example, E. H. Dale: Some Geographical Aspects of African Land-Locked States, *Annals Assn. of Amer. Geogrs.*, Vol. 58, 1968, pp. 483-505.

² David Hilling and Brian S. Hoyle: Seaports and the Economic Development of Tropical Africa, in *Seaports and Development in Tropical Africa* (edited by B. S. Hoyle and D. Hilling; Macmillan, London, 1970), pp. 1-9.

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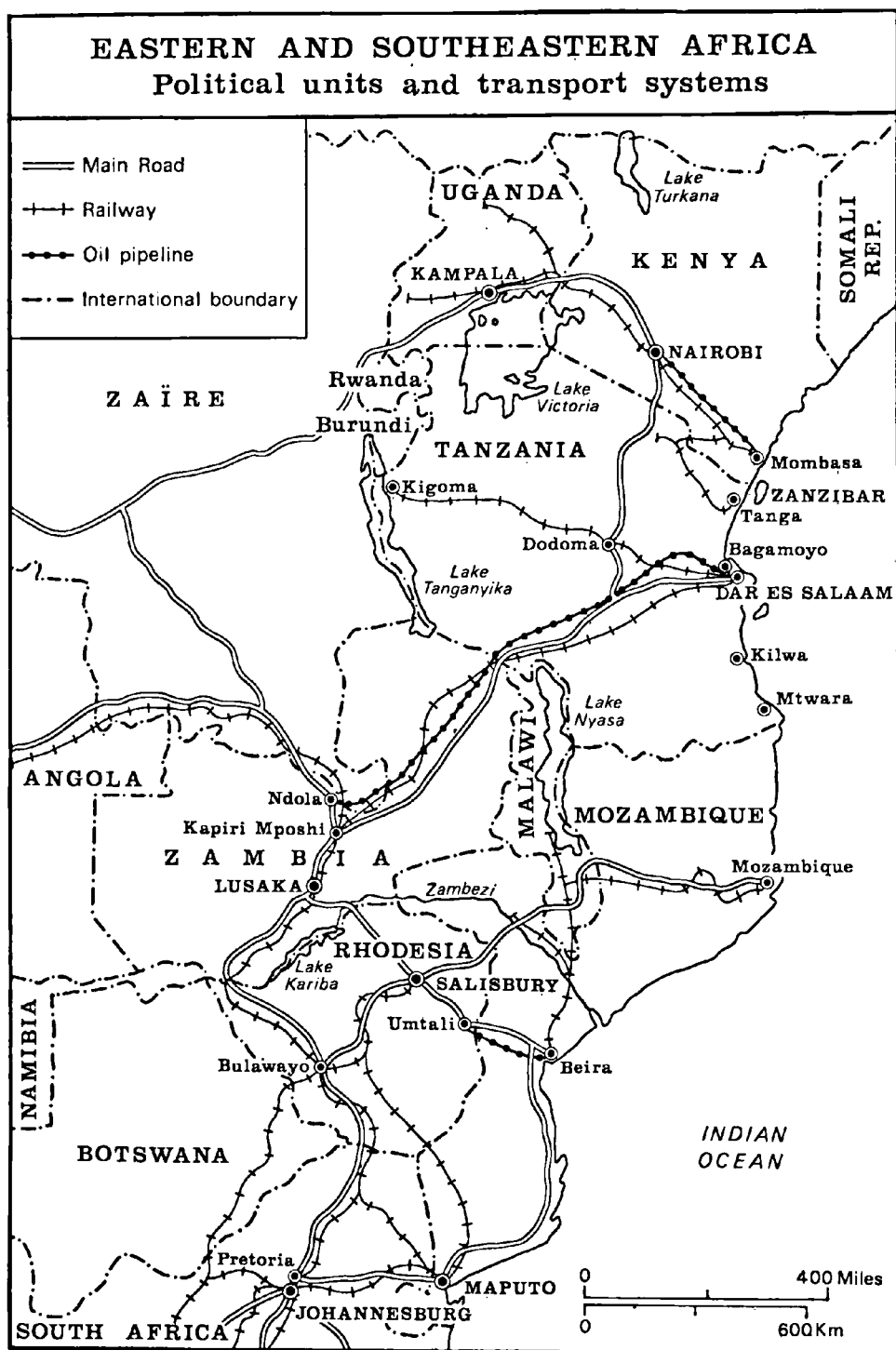


FIG. 1

that separates the newly independent black states of eastern and southern Africa from the white-controlled south, the position of Zambia has been particularly problematical. As an inland state that relies on copper ore for more than 90 percent of its export earnings, Zambia's transport dependence on its neighbors places it in an especially vulnerable position. Because Zambia was regarded during its formative

TABLE I—CARGO THROUGHPUTS AT EAST AFRICAN SEAPORTS, 1965 AND 1975
(In thousands of deadweight tons)

PORT	DRY CARGO IMPORTS		DRY CARGO EXPORTS		BULK OIL TRAFFIC		TOTAL THROUGHPUT	
	1965	1975	1965	1975	1965	1975	1965	1975
Mombasa	923	842	1,090	1,450	2,459	3,658	4,512	6,040
Dar es Salaam	347	1,235	303	684	255	1,968	922	3,888
Tanga	25	192	172	162	14	26	211	381
Mtwara	18	54	95	102	4	18	131	174
TOTAL ^a	1,314	2,709	1,644	2,580	2,742	8,425	5,776	11,483

Sources: *East African Railways and Harbours, Ann. Rept., 1965*; and East African Harbours Corporation records.

^a Totals include transshipment, and bulk molasses shipments through Mombasa.

colonial period as part of British Central Africa, and because the area was politically and economically incorporated into the abortive Central African Federation (1953 to 1963), Zambia emerged in transport terms as an independent state with links within the spatial economic system of southern Africa. Rhodesia's declaration of independence rendered this orientation and involvement politically unacceptable, and Zambia has since attempted—with considerable success—to realign itself economically and politically toward eastern Africa, particularly toward Tanzania.

In practical transport terms the relative success of this process of reorientation has depended on the facilities provided by the port of Dar es Salaam, linked to Zambia by road services, by an oil pipeline, and by the Chinese-sponsored Tanzania-Zambia railway (TZR), which began service in 1975. Although Dar es Salaam traditionally has dealt with traffic flows to and from Rwanda, Burundi, and eastern Zaïre, the extension of the hinterland to include Zambia has placed severe pressures on the port. Together with the growing demands of the Tanzanian economy, these pressures have resulted in considerable physical expansion of port facilities and in the emergence of a new axis of development along the Dar es Salaam-Zambia route.

ENVIRONMENTAL CONDITIONS

The setting of the port of Dar es Salaam, like that of other elements in the East African seaport hierarchy (Table I), offers a variety of advantages and some disadvantages in both general and local terms. Broadly, the economic development of the modern East African port hierarchy is based on several favorable conditions of situation—involving principally the commercial sea-lanes of the Indian Ocean and the economic patterns and transport networks of the East African hinterland—and on site conditions at specific locations that do not offer any insuperable obstacles to port expansion.³ In terms of economic geography the general locational conditions that favor port growth in East Africa today have largely developed since the mid-nine-

³ Environmental and other factors affecting the growth of East African seaports are examined in Brian S. Hoyle: *The Emergence of Major Seaports in a Developing Economy: The Case of East Africa*, in *Seaports and Development in Tropical Africa* [see footnote 2 above], pp. 225-245.

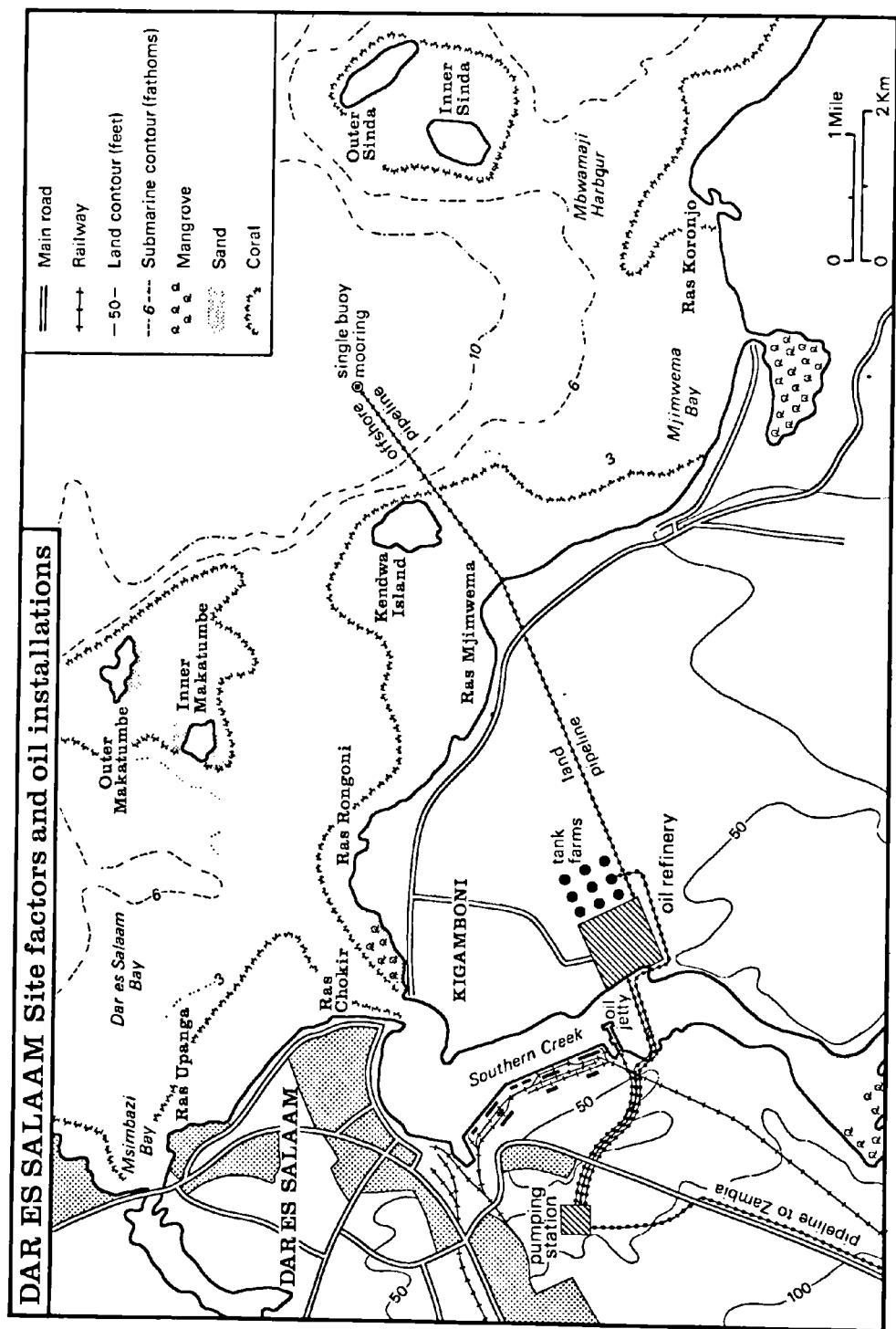


FIG 2

teenth century; in earlier eras the East African littoral lay between an undeveloped hinterland and a maritime trading system based on the monsoonal wind regime of the Indian Ocean. Colonial and postcolonial developments on both landward and seaward sides have widened and intensified the significance of East African seaports, so that today they no longer lie in a backwater but maintain links with all of the inhabited continents. East Africa, especially Tanzania, is fortunate in possessing several good natural harbors, where adequate shelter and deep water close inshore have permitted the growth of modern seaports in reasonably flexible conditions, relatively free from dependence on the wide tidal fluctuations that seriously restrict shipping movements in many other parts of the world.⁴

The physical framework for port development at Dar es Salaam is provided by a ria (Fig. 2), one of a series of drowned river valleys on the East African coast produced by discontinuous alterations of the ocean level during Pleistocene and more recent times. From a navigational standpoint Dar es Salaam is in some respects the most difficult of the East African ports, for in spite of its deepwater facilities the harbor is relatively small and the entrance constricted. The entrance channel, at the north-eastern end of the basin, is narrow and angular, and it is obstructed by coral growth. Shipping movements in and out of the basin are subject to restrictions depending on draft and the state of the tide.⁵ Vessels that do not exceed 150 meters in length are normally allowed to enter, and the maximum permissible draft varies from 6 to 9 meters according to tidal circumstances. Beyond the main basin, where the older port installations are located, Southern Creek is navigable for 2.5 kilometers for ships drawing up to 9 meters of water; here, deep water close inshore is lacking and berths have been developed partly on reclaimed land.

ORIGINS AND GROWTH

Dar es Salaam has no history of commercial activity before the third quarter of the nineteenth century. Arab and Portuguese navigators and writers largely ignored the Tanzanian coast between Kilwa and Bagamoyo; but the latter, standing at the seaward terminus of the long overland caravan route to Lake Tanganyika, flourished in the mid-nineteenth century because of its proximity to the Arab emporium at Zanzibar, which it served as a mainland outpost. Later, as ships and cargoes increased in size, and as more accurately controllable steamships were introduced, the advantages of shelter and deep water at Dar es Salaam became increasingly apparent, and the open roadstead port of Bagamoyo declined into insignificance.⁶

The foundation of a new port and town within the harbor of Dar es Salaam is attributed to Seyyid Majid (Sultan of Zanzibar, 1856–1870), who seems to have opened the new seaport formally in 1867.⁷ His motive may have been the extension and consolidation of the Arab trade network on the East African mainland, or, as John E. G. Sutton suggests, a move to counteract British influence (and the antislav-

⁴ A comparative survey of the five deepwater terminals serving Kenya, Tanzania, and adjacent areas is provided by Brian S. Hoyle: *The Seaports of East Africa* (East African Publishing House, Nairobi, 1967).

⁵ The maximum tidal range is 3.7 meters and the maximum current in the channel is 3.5 knots at the spring tides.

⁶ W. T. Brown: Bagamoyo, An Historical Introduction, *Tanzania Notes and Records*, Vol. 71, 1970, pp. 69–83.

⁷ The evidence is reviewed by Sir John Gray: *The Opening of Dar es Salaam as a Seaport*, *Tanganyika Notes and Records*, Vol. 59, 1962, p. 224.

ery campaign) that received encouragement from French diplomats.⁸ After 1870, however, the new port and town fell temporarily into decay, and development was not renewed until the turn of the century. Dar es Salaam replaced Bagamoyo as the seat of government in German East Africa in 1891, and some primitive port installations were introduced after 1900.⁹ The construction of the central Tanganyika railway, which was started in 1905 and reached Kigoma in 1914,¹⁰ consolidated the position of the new port and laid the foundations for its modern role as chief commercial cityport of Tanzania.

The role of the port of Dar es Salaam as a gateway to and from tributary areas beyond the national territory first received formal acknowledgment after the defeat of German forces in World War I, when Tanganyika became a League of Nations mandated territory under British administration. In 1921, under the terms of the Milner-Ortiz Convention, sites at Dar es Salaam and Kigoma were leased to the Belgian government in return for an annual rent of one franc, in order to facilitate the flow of traffic to and from the eastern Belgian Congo. The Dar es Salaam site was originally the more northerly of the two lighterage berths (Fig. 3), first constructed in 1907. The port continued to offer only small-scale lighterage facilities for almost fifty years, for no major changes were introduced until after World War II. Three deepwater berths were completed in 1956 (Fig. 4). At Berth 1 a degree of priority is given to ships discharging or loading more than 50 percent of cargo destined for or originating from Zaïre, Rwanda, or Burundi. The berth is now administered by a quadripartite commission known as the Agence Maritime Internationale, which was established by the four governments involved.

From 1965 to 1975 additional deepwater berths were constructed on the western side of Southern Creek (Fig. 3), resulting in a more rapid expansion of installations and throughput. In the late 1960's demand for more extensive facilities at the port was considerably accelerated by sharp increases in Zambian traffic through the port, and the construction of new deepwater berths was supported by loans and grants provided by the Zambian government as well as by the International Bank for Reconstruction and Development (IBRD) and other sources. Specialized facilities for the reception and refining of crude oil were introduced in 1966. An existing small jetty in Southern Creek, linked by a submarine pipeline to an oil refinery on the opposite side of the creek at Kigamboni, was rehabilitated as a crude-oil tanker terminal. More recently, the increasing size of oil tankers and the physical limitations of the harbor with respect to depth of water and alignment of channels has necessitated the introduction of alternative facilities for the reception of crude oil.

PORT INSTALLATIONS

The port of Dar es Salaam is now able to accept vessels of up to 20,000 tons deadweight and can provide simultaneous anchorage for fifteen deepwater vessels. To the north of Kurasini Creek lies the older part of the port, where four lighterage wharves are now being modernized; to the south, eleven berths offer more than 2,000

⁸ John E. G. Sutton: Dar es Salaam, A Sketch of a Hundred Years, *Tanzania Notes and Records*, Vol. 71, 1970, pp. 1-19.

⁹ Clement Gillman: Dar es Salaam 1860-1940: A Story of Growth and Change, *Tanganyika Notes and Records*, Vol. 20, 1945, pp. 1-23.

¹⁰ Clement Gillman: A Short History of the Tanganyika Railways, *Tanganyika Notes and Records*, Vol. 13, 1942, pp. 1-43.

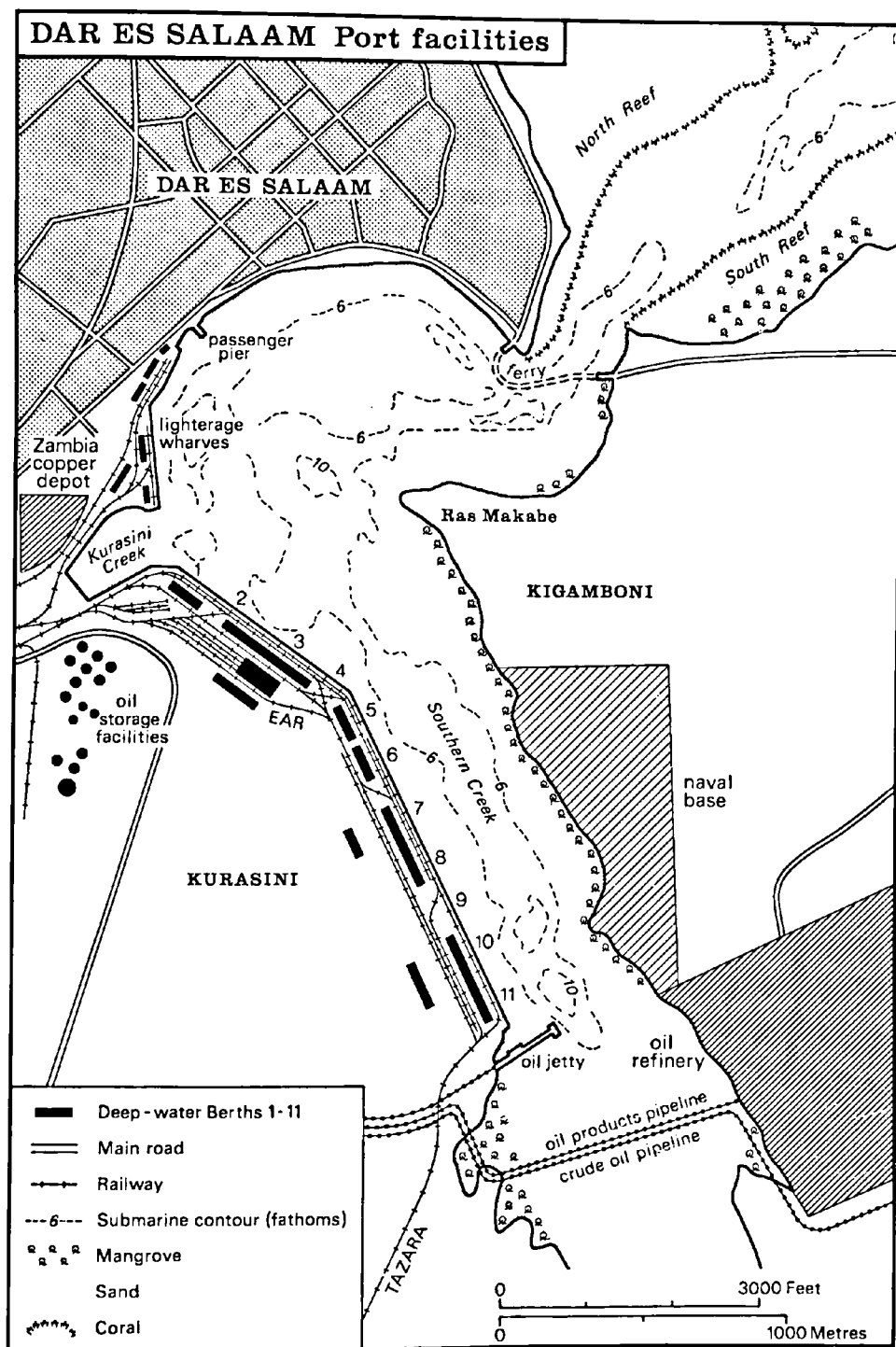


FIG. 3

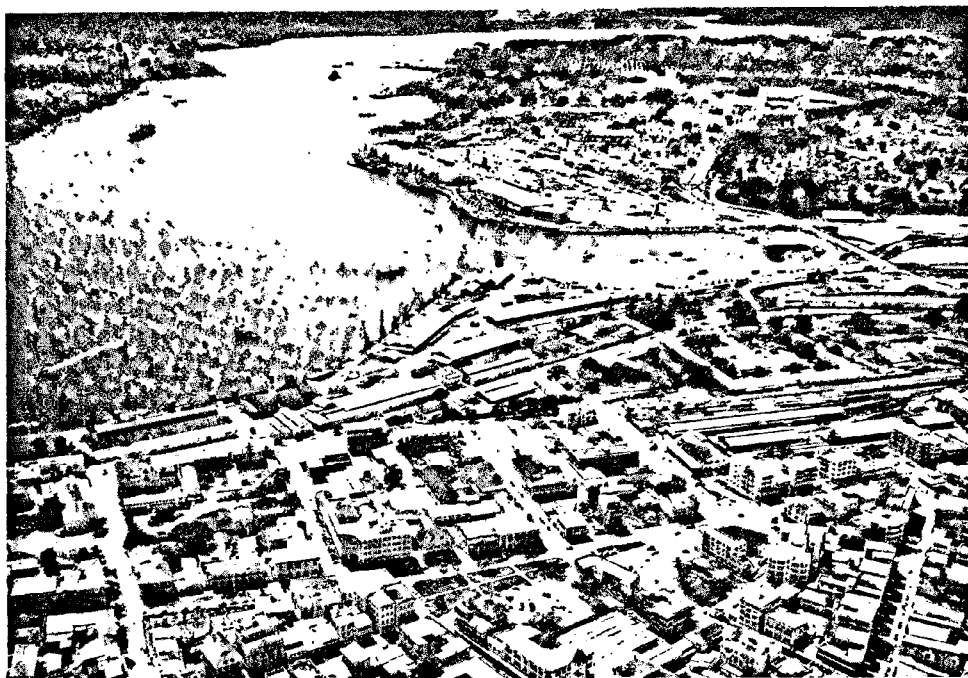


FIG. 4.—Dar es Salaam in the late 1960's. The city center is in the foreground. The lighterage quays are separated by Kurasini Creek from the three deepwater berths opened in 1956. Southern Creek (top left) now contains eight additional deepwater berths. (Photograph courtesy East African Harbours Corporation.)

meters of deepwater quayage (Fig. 3). The rapid expansion of facilities at Dar es Salaam between 1965 and 1975, owing principally to the incorporation of Zambia into the hinterland, reflects a transformation in the scale of activity at the port, and with all the new berths now in service every obvious site for development within the original harbor is occupied.

All of the deepwater and lighterage berths at Dar es Salaam are served by rail: Berths 1 through 4 by East African Railways (EAR) and Berths 5 through 11 by the TZR as well as by the EAR. During the period from 1965 to 1975 road transport to and from the port was generally more important than rail transport, but this pattern may change as increasing use is made of the TZR.¹¹ Transit sheds and storage areas in the port were supplemented during the recent period of rapid growth by a 45,000-square-meter storage depot at Ubungu, 10 kilometers west of Dar es Salaam, which provided transshipment facilities for Zambian cargoes transported by road. At the quayside, the sheds that serve Berths 7 through 11 are designed to be easily dismantled should these berths be converted in the future to handle containerized throughput.

Facilities for the bulk handling of petroleum are available both within Dar es Salaam harbor and at Mjimwema Bay (Fig. 2). The Kurasini Oil Jetty, located at the southern end of the deepwater berths in Southern Creek, has a minimum depth

¹¹ Special attention is given to problems of road transport in R. Hofmeier: *Transport and Economic Development in Tanzania*, Ifo-Institut für Economic Research, African Studies No. 78, Weltforum Verlag, Munich, 1973.

alongside of 10 meters and can accommodate tankers that do not exceed 20,000 tons deadweight. Originally designed to receive refined products, the jetty has also served as a crude oil terminal since the opening in 1966 of the Tanzanian and Italian Petroleum Company (TIPER) oil refinery on Kigamboni peninsula between Southern Creek and the Indian Ocean; the jetty is linked to the refinery by a submarine pipeline. Increasing demands for oil in Tanzania and Zambia in the late 1960's emphasized the need for improved oil reception facilities. As a direct result of the Rhodesian action in 1965 the traditional northward flow of oil supplies into Zambia was stopped, and because at that time road links between Tanzania and Zambia were unsatisfactory and rail links nonexistent, a pipeline from Dar es Salaam was introduced.¹² Opened in 1968, the TAZAMA oil pipeline links the port with the Zambian Copperbelt. Originally used to transport oil products from the TIPER refinery, the pipeline now chiefly carries crude oil to the Industrial Development Corporation (INDECO) refinery at Ndola, Zambia, which was opened in 1975. At Dar es Salaam, the extension of deepwater berths and the physical limitations of the harbor underlined the practical and economic advantages to be gained by providing alternative crude oil reception facilities outside the harbor so that larger tankers could be used. A single-buoy-mooring (SBM) installation at Mjimwema Bay was introduced in 1973 and has provided a satisfactory solution to this problem.¹³ The SBM installation is basically an offshore tanker berth that can be used in all but the most severe weather conditions; it is linked to the refinery by a submarine pipeline and by land pipelines and is capable of accepting tankers of up to 100,000 deadweight tons.

At Dar es Salaam shipping turnaround improved markedly immediately after deepwater quays were opened there in 1956, an event that relieved a considerable degree of congestion and changed the character of the principal port operations from lighterage to normal wharfage. At the time this development gave rise to the widespread opinion that the port was equipped with adequate facilities for handling the probable volume of traffic for a good many years to come. Ten years later, however, this optimistic opinion was no longer justified, and plans were implemented for the extension of deepwater quayage. The rapid growth of port traffic at Dar es Salaam during the period from 1965 to 1975 caused an increase of congestion, especially during the early 1970's. As a result, surcharges were imposed on cargoes loaded onto East Africa/Europe Conference vessels.

PORT THROUGHPUT

The general pattern of cargo throughput at Dar es Salaam between 1965 and 1975 is shown in Figure 5. Total traffic handled increased during the period by 320 percent (imports by 400 percent, exports by 184 percent). Bulk oil imports, which rose by 600 percent during this period, account for a high proportion of these increases, and oil traffic as a whole (including bunker and bulk oil exports) rose by 665 percent. Although these increases reflect in part the growing demands of the Tanzanian economy and the opening of an oil refinery at Dar es Salaam in 1966, the major factor involved in increased oil import flows was the inauguration of the TAZAMA pipeline to Zambia in 1968 and the utilization of this pipeline for crude oil supplies to the

¹² For details see Ieuan L. Griffiths: *The Tazama Oil Pipeline*, *Geography*, Vol. 54, 1969, pp. 214-217.

¹³ "Report on Single Buoy Mooring for Oil Tankers and Ancillary Services at Mjimwema Bay, Dar es Salaam" (East African Harbours Corp.; Rendel, Palmer and Tritton, London, 1971).

DAR ES SALAAM Cargo throughput 1965-1975

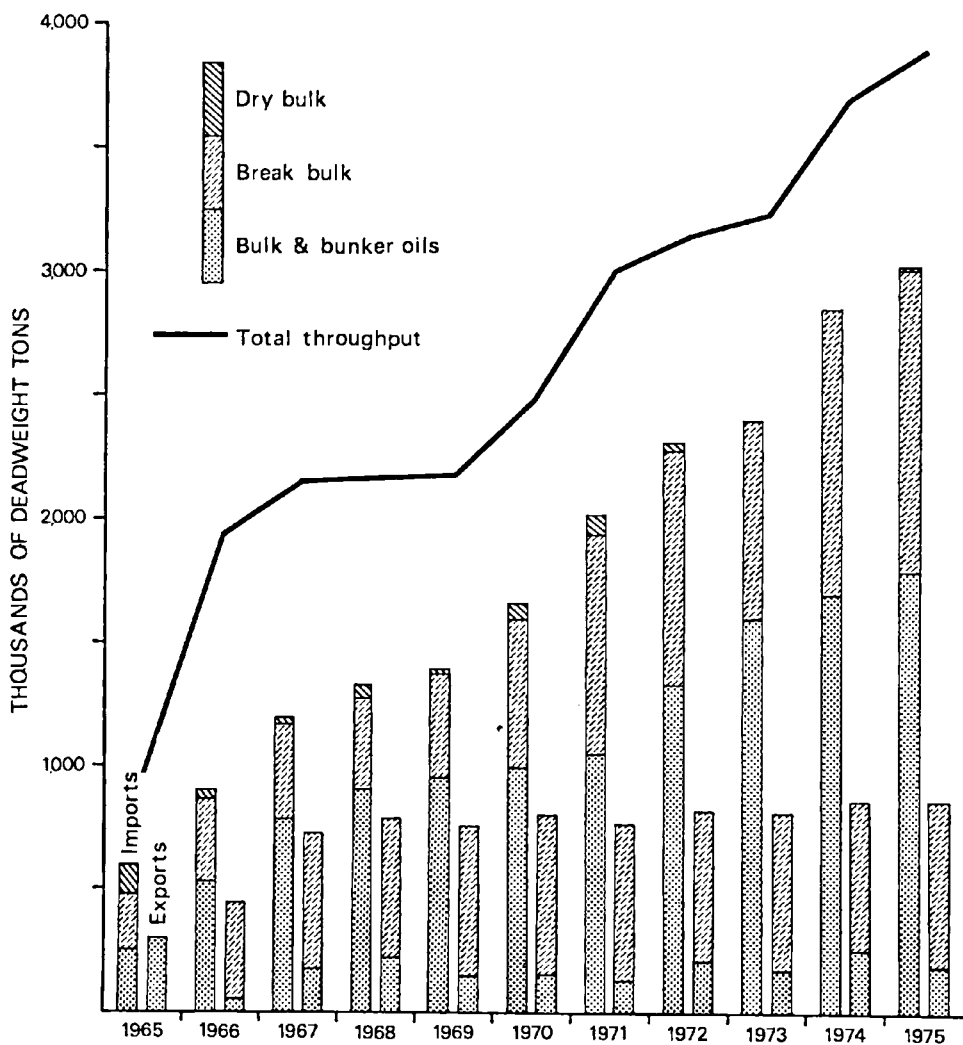


FIG. 5.—Cargo throughput at Dar es Salaam, 1965-1975. Sources: *East African Railways and Harbours, Ann. Repts.*, Nairobi, annually to 1969; *East African Harbours Corporation, Ann. Repts.*, Dar es Salaam, annually from 1970; and East African Harbours Corporation files.

Ndola refinery since 1975. Dry cargo throughput at Dar es Salaam also increased substantially between 1965 and 1975, though not quite so dramatically as oil flows: imports rose by 256 percent, exports by 126 percent, and total dry cargo traffic by 195 percent.

Cargo throughput at Dar es Salaam is thus increasingly dominated by import flows, which constituted 65 percent of total traffic handled in 1965 and 78 percent in 1975. Although increases in oil imports account to a large extent for this situation, dry-bulk and break-bulk imports accounted for 32 percent of total cargo throughput in 1975 (38 percent in 1965). Dry cargo exports (Table II) show little or no increase in volume in the period under review, with the exception of Zambian copper which accounts for 92 percent of the total increase in import cargo throughput. Before the

introduction of Zambian traffic through the port in 1965, the two outstanding export commodities handled at Dar es Salaam were sisal and cotton. For many years sisal was a leading export item, and during the 1959-1964 period more than 100,000 harbor tons a year were shipped—more than a third of the total volume of exports passing through the port at that time.¹⁴ Between 1965 and 1975, however, sisal exports fell from

TABLE II—PRINCIPAL DRY CARGO EXPORTS THROUGH THE PORT OF DAR ES SALAAM, 1965 AND 1971-1975
(In thousands of harbor tons)

COMMODITY	1965	1971	1972	1973	1974	1975
Copper (Zambia)	18	212	206	276	240	367
Cotton	106	143	161	149	112	94
Copper (Zaire)	20	95	80	74	87	25
Sisal	91	59	63	45	36	50
Oil seed cake	39	43	53	25	25	39
Coffee	20	21	26	21	18	32
Cashew nuts	12	21	26	28	26	24
Tea	15	19	23	23	23	19
Tobacco	4	14	16	17	28	22
Twine	0	16	12	14	14	5
Hides and skins	10	11	10	21	10	11

Sources: *East African Harbours Corporation, Ann. Repts., 1971-1975*, and East African Harbours Corporation records.

91,000 to 50,000 harbor tons, as a result of the fluctuating fortunes of hard fibers on the international market and of consequent efforts to diversify agricultural production and to increase domestic sisal consumption in manufacturing industries. Cotton exports, on the other hand, have generally continued to increase; a rapid rise during the 1950's was largely attributable to increased acreages in northwestern Tanzania and to the stimulus of a government price stabilization scheme. Market conditions in Europe and the Far East remain good, and, despite somewhat lower throughput totals in 1974 and 1975, the general outlook for cotton exports through Dar es Salaam is reasonably bright. Coffee exports through the port are relatively slight in comparison with those moving through Mombasa, but they include substantial quantities that originate in Zaire, Burundi, and Rwanda. Other important and regular export commodities handled at Dar es Salaam include cashew nuts and locally manufactured twine. Exports of tea and tobacco have also increased in recent years.

To a greater extent than other East African seaports Dar es Salaam serves as a gateway for the landlocked states beyond its national hinterland. In this respect the port bears comparison with certain West African ports (notably Dakar, Abidjan, and Lagos) and with Beira and Maputo, the principal ports of neighboring Mozambique. Traffic between the Tanzanian coast and parts of Central Africa and the Zaire basin predate the colonial era; early African trade routes were elaborated by Arab merchants in the nineteenth century and consolidated by the German railway builders of the early twentieth century.¹⁵ A project designed to link the central Tanganyika

¹⁴ A harbor ton is either 1,000 kilograms or one cubic meter, whichever unit is used for purposes of raising port charges.

¹⁵ Recent studies of early African trade routes in eastern Africa include Edward A. Alpers: *The Coast and the Development of the Caravan Trade, in A History of Tanzania* (edited by I. N. Kimambo and A. J. Temu; East African Publishing House, Nairobi, for the Historical Assn. of Tanzania, 1969), pp. 35-56; and J. Lamphear: *The Kamba and the Northern Mrima Coast, in Pre-Colonial African Trade: Essays on Trade in Central and Eastern Africa before 1900* (edited by R. Gray and D. Birmingham; Oxford Univ. Press, London, 1970), pp. 75-101.

railway with Northern Rhodesia in the 1920's was abandoned because it would have cost too much,¹⁶ and not until the postindependence era were increasingly reliable and varied communications established between Tanzania and Zambia. The improvement of major roads, the introduction of oil pipelines, and the completion of the TZR have facilitated the emergence of a new axis of development in southern Tanzania, which is now being consolidated as agricultural patterns are diversified and as plans for coal mining and iron mining are elaborated. Situated at the seaward terminus of this axis, the port of Dar es Salaam has handled a rapidly increasing volume of traffic, especially Zambian traffic, in the decade between the declaration of independence in Rhodesia and the inauguration of the TZR. The growth of Zambian cargo throughput at Dar es Salaam thus represents a politically stimulated change in the structure of traffic flows through the port.

Other non-Tanzanian throughput has increased since 1965, though not to the extent of Zambian traffic (Fig. 6). Traffic to and from Rwanda, Burundi, and eastern Zaïre has risen substantially but maintains a traditional structure: exports of primary or semiprocessed products (coffee, copper); imports of petroleum products and of a varied mixture of consumer goods. Zambian traffic consists almost exclusively of exports of semirefined copper bars, and imports are dominated by oil flows. During the period non-Tanzanian traffic assumed a hitherto unprecedented importance at Dar es Salaam. In 1965, when Zambian throughput was negligible, traffic to and from Rwanda, Burundi, and Zaïre constituted less than 10 percent of the total cargo traffic of less than one million tons handled at the port; in 1975, when total throughput approached 4 million tons, Zambian traffic accounted for 21 percent and non-Tanzanian traffic as a whole accounted for 24 percent of cargoes handled. The impact of this pattern and rate of traffic growth has been considerable in terms of the need to expand port installations quickly. New facilities and the associated major changes in hinterland transport arrangements have been developed in less than a decade with the aid of substantial foreign grants and loans.¹⁷ Within the port itself, however, problems of adjustment have been severe as the pressures of a period of rapid growth have been felt at the quayside.

PORT OPERATION

Changes in the administration of port services in East Africa have reflected the growth and development of interterritorial and interstate cooperation within the area. In 1948, under the East Africa High Commission, the Kenya and Uganda Railways and Harbours was amalgamated with the Tanganyika Railways and Ports Services to form the East African Railways and Harbours Administration. After the emergence of independent states in East Africa in the early 1960's, the East Africa High Commission became the East African Common Services Organization; the East African Railways and Harbours Administration continued, however, to provide services

¹⁶ The pioneer East African geographer Clement Gillman was primarily responsible for this survey. He discussed his "Report on the Preliminary Survey for a Railway Line to Open Up the South-West of Tanganyika Territory" (Crown Agents, London, 1929) in a short note entitled "Railway for South-West Tanganyika Territory" in the *Geographical Journal* (Vol. 75, 1930, pp. 379-380). Other insights into this early project to link Tanzania and Zambia by rail can be found in M. F. Hill: *Permanent Way: The Story of the Tanganyika Railways* (East African Railways and Harbours, Nairobi, 1957).

¹⁷ The implementation of the second EAHCO Development Programme (1972-1976) relied substantially on long-term loans from banks and from the IBRD.

DAR ES SALAAM Non-Tanzanian cargo throughput 1965 - 1975

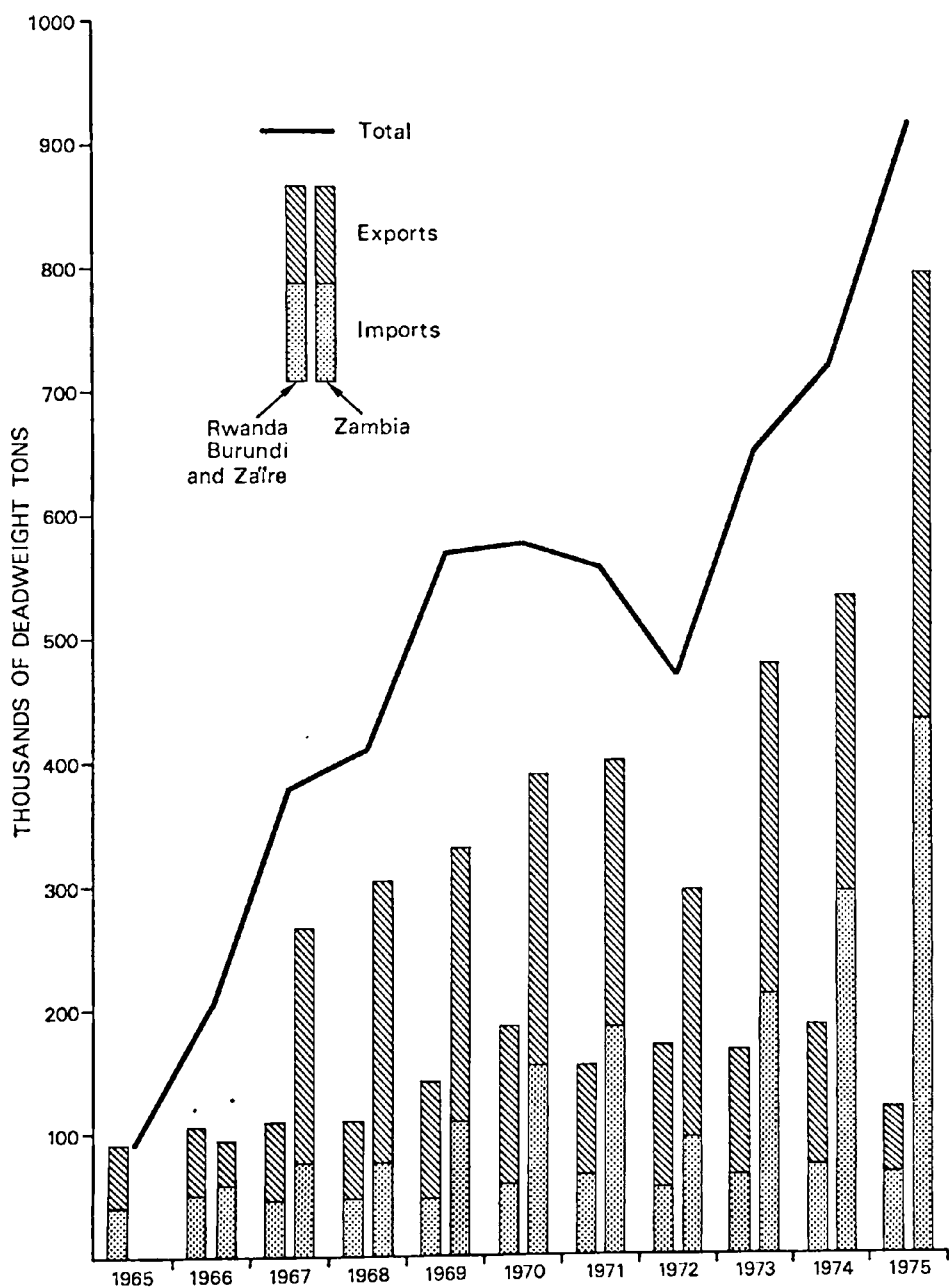


FIG. 6—Non-Tanzanian cargo throughput at Dar es Salaam, 1965–1975. Compiled from data supplied by the East African Harbours Corporation.

throughout the mainland states. The formation of the East African Community in 1967 involved some reorganization of the administration of transport services; the East African Railways and Harbours Administration was divided into two separate organizations, the East African Railways Corporation (EARC) and the East African Harbours Corporation (EAHC). These two bodies, together with the East African Posts and Telecommunications Corporation and the East African Airways Corporation, were responsible during the period from 1967 to 1977 to the East African Community through its communications council. The EAHC was the statutory port authority for all the mainland seaports of East Africa. The headquarters of the corporation, and the office of the director general, were in Dar es Salaam. The corporation was responsible for port management, the construction and maintenance of port installations, the provision of shore equipment, and the operation of port services such as pilotage at the four mainland deepwater ports and also at a number of minor harbors.¹⁸ Since 1975, these services have come increasingly under the direct control of the Kenyan and Tanzanian governments as the level of international cooperation in East Africa has declined.

Under a system that came into operation in 1964, all cargo handling at East African mainland seaports during the years 1963-1975 was carried out on behalf of the EAHC by its agent, East African Cargo Handling Services Limited (EACHS). Cargo handling, divided between the two complementary services of stevedoring and shore-handling, had previously been carried out by five different companies. In 1962, when productivity was declining at all East African seaports and when labor unrest was causing serious concern, it became increasingly obvious that the old system was unsatisfactory. The division of responsibility for stevedoring among four private firms had led to a marked loss in efficiency, adversely affecting the number of days spent in port per ship and the time taken to clear cargo through the ports. The government of Tanganyika then engaged Amos Landman, manager of the port of Haifa, to examine the working of the existing system, with special reference to Dar es Salaam, and to make recommendations for improvements. Landman's report, which in many respects was taken to refer to all four mainland seaports, recommended that, in the interests of cargo handling and the national use of costly equipment and labor, complete coordination of ship- and shore-working operations should be effected through the medium of a single operating company under the direct authority of the East African Railways and Harbours Administration.¹⁹ This reorganized system of port working was widely supported and was accepted by the three East African governments, and the result was the formation of EACHS on January 1, 1964.

The East African port industry depends essentially on its manpower resources, and the structure and organization of port labor is a matter of considerable social and political as well as economic importance. In 1975 EACHS employed more than 17,000 persons, of whom about 40 percent were in Dar es Salaam; about 70 percent of the employees were manual laborers. Traditionally in Tanzanian ports all manual laborers were paid either monthly on a permanent basis or daily on a casual basis. At Dar es Salaam the number of casual workers was much higher than at Mombasa. All casual employment in the Tanzanian seaports has now ceased and at the four mainland ports of East Africa laborers are either paid monthly or, when necessary to

¹⁸ Tanzania's fourth deepwater port, Zanzibar, is operated by the government of Zanzibar.

¹⁹ Amos Landman: Report on the Port of Dar es Salaam (Haifa, 1962).

cover seasonal requirements, held on a weekly register with a minimum weekly guaranteed wage.

An important element in the socioeconomic and political structure of the port industry is the role of trade unions. The roots of unity among port workers in Tanzania have been traced to the 1930's.²⁰ During the 1950's this group consciousness was directed primarily against the colonial system, and the growth of trade unionism and the consolidation of interterritorial association between the Tanganyikan and Kenyan port workers' unions led to joint wage demands. The strength of the trade unions in the port industry was the basic factor in the formation of EACHS in 1964 and the consequent exclusion of private enterprise from the seaports of East Africa. In the early 1970's some interstate competition between unions arose, but an interstate joint industrial council established in 1973 has achieved a measure of standardization of wages and conditions of employment.

PRODUCTIVITY IN THE PORT INDUSTRY

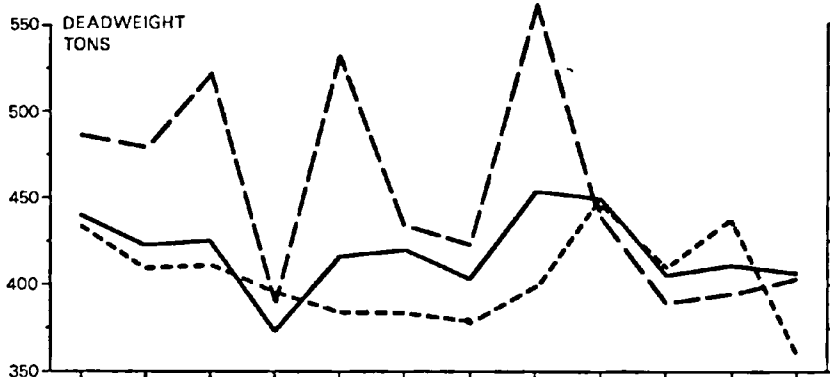
A good deal of attention is devoted in the port industry to ways of measuring and assessing productivity, as a means of demonstrating the degree of efficiency with which the capacity of the ports is being utilized. Questions of port capacity, efficiency, and productivity are difficult to define precisely, since all three terms are essentially arbitrary. Capacity is assessed in terms of the tonnage of goods that a port may realistically be expected to handle in a year, given the known circumstances of installations, labor conditions, and methods of working. Efficiency is a concept in which the volume and cost of port throughput are set against productive resources of labor, land, capital, and technical equipment. Measures of productivity are designed to describe aspects of port efficiency, but by their nature they can only be partial and selective. No accurate, realistic, and comprehensive measure of port productivity is practicable, in view of the wide range of factors that affect port throughput, many of which lie quite outside the control of the port and cargo-handling authorities. Various measures are commonly used, however, and all seek to relate port throughput to one or more of the factors involved. These factors include basic variables—technological conditions, management systems, capital resources, and labor relations—as well as a number of less predictable but nevertheless crucial influences, such as late arrival of ships, land transport problems, and weather conditions.

Basic data on the volume of cargo handled at a port, or the average number of days required to work a ship, are not in themselves measures of port productivity. Port installations may be underused, even if total throughput is high, resulting in low efficiency; and ships of varying size may load or discharge varying proportions of their cargo at a given port. A measure of productivity which, to a large extent, successfully ignores these defects is that which describes variations in tonnage handled per ship working day (Fig. 7A). Rates at Dar es Salaam are generally lower than at Mombasa and vary considerably through the year. One of the most potent factors affecting throughput per ship working day is the weather. During the early part of the year, especially the period between March and May and again at the end of the year (October to December), the coastlands of East Africa experience heavy rainfall which frequently interferes considerably with ship working. Conversely, the peak rates

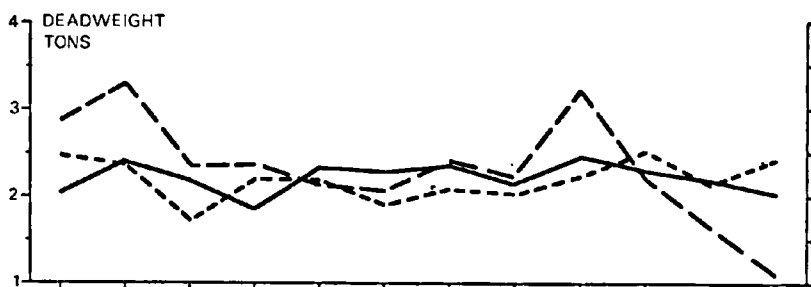
²⁰ John Iliffe: *A History of the Dockworkers of Dar es Salaam, Tanzania Notes and Records*, Vol. 71, 1970, pp. 119-148.

DAR ES SALAAM Port productivity 1971-1975

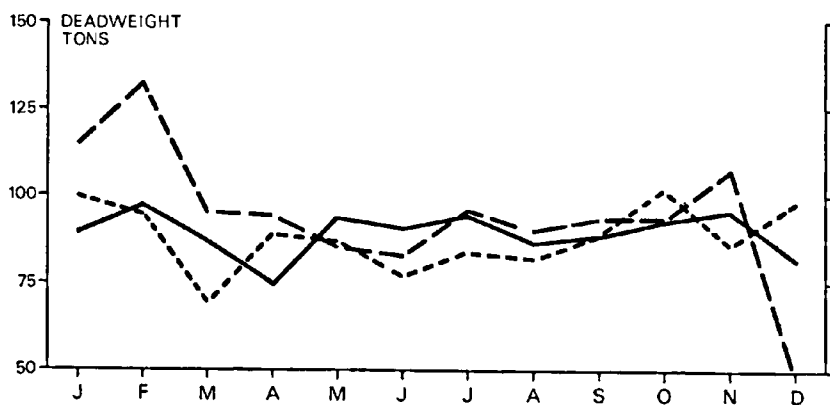
A Throughput per ship working day



B Tonnages handled per man/shift



C Monthly net productivity index



----- 1971 - - - - 1975 ——— 1971-1975 (five-year average)

achieved in the third quarter of the year are related to better working conditions during the cool dry season.

An alternative measure of port productivity is throughput per appliance hour, which relates tonnages handled to hours worked by port appliances (quay cranes and/or ships' gear). In some respects this is a finer measure of port productivity than throughput per ship working day, since only the actual hours worked by appliances within each ship working day are taken into account. At Dar es Salaam export rates normally exceed those for imports, and those for the deepwater berths are normally higher than those for the lighterage quays. From 1965 to 1975 the monthly average tonnage per appliance hour handled, especially export tonnages at the deepwater quays, increased substantially. This improvement was due partly to the provision of new handling equipment and partly to the increased flow of homogeneous cargo, especially Zambian copper.

Port productivity may also be measured in terms of throughput per man/shift, which relates tonnages handled to hours worked by a known number of workers, given the facilities and equipment of the port. Figure 7B shows that at Dar es Salaam, as at other East African ports, rates vary little, with only a slight tendency toward improvement during the 1965-1975 period. Given the increased tonnages handled, static throughput per man/shift data obviously imply an increased labor force. Considerable caution is required in interpreting these data, however, since rates depend not only on working conditions and type of cargo handled but also on a variety of social factors, such as health and temperament, and on attitudes to work, which may affect the efficiency of an individual worker.

These various measures of port productivity have their individual merits and imperfections, and it may be argued that an index that attempts to relate throughput to total costs of operation might prove to be a more realistic economic assessment. Because throughput per man/shift is used as the basis for the monthly net productivity index (Fig. 7C), EACHS appears to favor it as the most useful measure now generally available. Unfortunately, at Dar es Salaam in recent years the index has frequently, indeed almost consistently, fallen below 100. There have, however, been some improvements, as a comparison of the 1971 and 1975 data suggests.

Whatever measures of productivity are used, it is generally accepted that cargo-handling rates at East African seaports in general, and at Dar es Salaam in particular, are low by world standards. This is especially true in terms of exports, and data for other tropical African seaports frequently reveal handling rates two or three times higher for exports, and marginally higher for imports, than those for Dar es Salaam. One reason for this situation is that some other ports handle larger volumes of homogeneous export cargo, but this can only be a partial explanation of an unsatisfactory situation. Although significant improvements in productivity may be expected as port installations are modernized and as technical innovations in cargo-handling methods are introduced, staff training and retraining schemes at all levels remain an extremely important aspect of port development strategy.²¹ The establishment of a Port Management Association for Eastern Africa in 1973 was designed to facilitate multinational cooperation in this field by setting up permanent machinery for the discussion and improvement of port management techniques.²²

²¹ "Management's Role in Promoting Productivity in the East African Community and the East African Corporations" (East African Community Project, Report of the Third Senior Executive Seminar, Arusha, 1972; United Nations Development Programme).

²² "Final Report of the Port Management Conference, East Africa, Mombasa 1973" (U.N. Econ. Commission for Africa, Addis Ababa, 1974).

TRAFFIC FORECASTS AND BERTH REQUIREMENTS

Reliable estimates suggest that the total cargo throughput at the four East African mainland deepwater ports will exceed 16 million tons in 1980, almost twice the 1970 level of 8.7 million tons.²³ For the port of Dar es Salaam the problem of forecasting cargo flows and berth requirements is rendered more complex by the Zambian situation. In 1970 Zambian traffic accounted for 16 percent of the total throughput at Dar es Salaam and for 30 percent of the dry cargo throughput; the Economist Intelligence Unit estimates for 1980 show that these proportions are expected to remain approximately the same as the total throughput rises to 5 million tons. Estimates of berth capacity at the port vary from 134,000 tons per berth per year for break-bulk imports to more than 300,000 tons per berth per year for copper exports, and the total dry cargo capacity of the port in the mid-1970's is approximately 2.5 million tons. On this basis, if copper exports rise as anticipated to more than 800,000 tons in 1980, almost three berths will be needed to handle this traffic alone; a predicted total dry-cargo throughput, excluding copper, of 2 million tons in 1980 will require another fourteen berths (assuming a break-bulk throughput of 150,000 tons per berth) or twelve berths (assuming 170,000 tons per berth). On the basis of these estimates it appears that the port's eleven deepwater berths, plus lighterage facilities approximately equivalent to one or two berths, will be fully occupied during the late 1970's and that congestion in the port is likely to recur.

The EAH Development Programme for 1972-1976 provided for the completion of the deepwater quayage extensions at Dar es Salaam up to and including Berth 11,²⁴ but the opening of the railway linking the port with the Zambian Copperbelt and the increases in Tanzanian traffic have meant that little spare capacity exists at the port. Economic trends suggest that five to ten additional general cargo berths may be needed by 1985, and engineering studies have been undertaken to assess possible sites for further development.²⁵ The occupation of all available deepwater sites on the western side of Southern Creek, the construction of a naval base on the eastern side of the creek, and the limitations of the harbor entrance to vessels that do not exceed 20,000 deadweight tons suggest that the main future development of the port should be outside the present harbor, to the south of the entrance channel. Further development south of Berth 11 on the western side of the creek would probably necessitate the removal of the oil jetty, and the shallow drafts in this area would mean high structural costs and extensive dredging. Marginal deepwater quays along the eastern side of the creek were included in 1929 in a master plan prepared by the East African Railways and Harbours Administration, but the occupation by the TIPER refinery and by the naval base of substantial areas along this waterfront leaves room for only five berths between Ras Makabe and the naval base and for possible additional berths south of the refinery. The disadvantages of these sites include circuitous land access, limited backup area to the north, and shallow drafts to the south. A site on the south side of the entrance channel has also been considered.

Outside the harbor entrance the most likely area for future development seems to

²³ "East Africa Transport Study" (10 vols.; Economist Intelligence Unit, London, 1970).

²⁴ "Development Programme, 1972-76" (East African Harbours Corp., Dar es Salaam, 1971).

²⁵ "Dar es Salaam Port Development Study: Inception Report" (Bertlin and Partners, in association with the Economist Intelligence Unit, prepared for the IBRD and the EAH, Dar es Salaam, 1973); and "Final Report" (Bertlin and Partners, in association with the Economist Intelligence Unit, prepared for the IBRD and the EAH, Dar es Salaam, 1975).

be the water area south of the Makatumbé Islands and sheltered from the east by Kendwa Island (Fig. 2). A reef that links Makatumbé and Kendwa could be exploited to provide protection from the east; an entrance channel would be established from the west. Large volumes of dredging and reclamation would be involved. Farther to the southeast, favorable sites for deepwater berths exist at Mbwamaji, adjoining Mjimwema Bay, where deep water is available with some natural protection provided by the Sinda Islands. It has been suggested that this area might be reserved for future use by large bulk carriers, such as might be required for coal exports or bauxite imports. However, extensive reclamation works would be required. Sites north of the present harbor entrance are not likely to be developed for port purposes in view of the cost and difficulty of providing land communications and in view of the present and proposed extent of residential and tourist development.

POLITICAL INFLUENCES AND TRANSPORT TRENDS

The growth of the port of Dar es Salaam thus illustrates the complex inter-relationships that exist between politics and transportation. The original Arab port of 1867, set in a small and sheltered harbor, was founded in the precarious political circumstances of the late nineteenth century: the tide of European colonialism was advancing, the Arab commercial empire was in decline, and the new port was destined to supplant the old roadstead at Bagamoyo. That roadstead had operated for many years as a vital node in the pre-European transport network, facilitating Arab commercial exploitation of eastern Africa as well as some long-established arteries of African trade. The coming of the Europeans—first the Germans, then the British—involved a new and expanded role for Dar es Salaam. Used as an established entry point, the growing port city became a transport node and a center of administrative authority in the complex economic and political system linking the African territory with European powers.

Replacement of the colonial framework in East Africa with a new system of independent states in the early 1960's involved the adaptation of inherited transport infrastructures to new geopolitical conditions. The old points of colonial entry have been particularly affected by this process of adaptation, and many have grown so rapidly that they dominate excessively the urban hierarchies of their respective countries.²⁶ As an established port city, Dar es Salaam has experienced conflicting trends. The growing throughput in the port has required an expansion of installations and equipment at an unprecedented rate. As a result of political pressures the scale and predominant nature of port activity at Dar es Salaam have changed substantially. As a city, however, Dar es Salaam has not experienced the growth associated with primate port cities in other less-developed countries. To some extent this is due to Tanzania's relatively low position in the development hierarchy, but in more specific and contemporary terms it is associated with the Tanzanian government's policy of regional development in a context of African socialism. In an attempt to bring some of the benefits of political freedom and economic growth to the people of Tanzania, government planning and investment have emphasized rural development and the

²⁶ The relationship between urban expansion and port development in tropical Africa is discussed in Brian S. Hoyle: *The Port Function in the Urban Development of Tropical Africa*, in *La Croissance urbaine en Afrique noire et à Madagascar* (Centre National de la Recherche Scientifique, Paris, 1972), Vol. 2, pp. 705-718.

creation of new, small-scale growth centers rather than the continued and accelerated expansion of established growth poles. The removal of the political capital functions from Dar es Salaam to Dodoma in central Tanzania is a major practical and symbolic step toward a more evenly distributed spatial pattern of development.²⁷

The modification of the East African transport system brought about by Central African political changes and pressures has clearly been most far-reaching at the port of Dar es Salaam; but conflicts have arisen elsewhere, and the changing geopolitical climate has not left other East African seaports entirely unaffected. In the early 1970's, when pressures on port services at Dar es Salaam were most severe, consideration was given to the possibility of using spare capacity at the small southern Tanzanian port of Mtwara. This proved impracticable, however, in view of the unsatisfactory hinterland transport links between the port and Zambia. Some Zambian cargoes have been handled at Mombasa, East Africa's primate port, but disagreements within the East African Community on matters of transport policy have marred this solution. An alternative strategy in Tanzania has been to divert some cargoes originating in or destined for locations within the national territory to the small northern Tanzanian port of Tanga, thus allowing Dar es Salaam to handle Zambian traffic with marginally greater flexibility. For a variety of reasons, including the very different nature of the Zambian and Tanzanian cargoes and the fact that apart from fertilizer traffic Tanga remains a lighterage port, this strategy proved unworkable except as a short-term emergency procedure. The inadequacy of these alternative strategies, which in a more advanced country with a more sophisticated transport network would have operated more smoothly, has repeatedly increased and reemphasized the pressures on the principal Tanzanian seaport.

When development at Dar es Salaam between 1965 and 1975 is examined in its environmental and historical context and in terms of the modern geopolitical framework, however, the achievements of the port are substantial in spite of the difficulties that have been encountered. Inevitably, in a period of rapid physical expansion under pressure of high traffic demands, congestion has at times been serious and both port management and the labor force have been severely criticized. Nevertheless, Dar es Salaam emerged from the significant decade enlarged, transformed, and increasingly efficient. The year 1975, in particular, is one to which management and workers alike can look back with satisfaction. Plans for further expansion and development are well advanced, and the future role of the port as a transport node and as a center of regional development seems assured.

²⁷ The decision to move the Tanzanian capital to Dodoma was announced in 1973. The transfer of government offices, begun in 1974, will probably not be completed until early in the 1980's.

A STAPLE INTERPRETATION OF SLAVERY AND FREE LABOR*

CARVILLE V. EARLE

THE economic interpretation of labor systems offers a powerful explanation of the geography of slavery and free labor in antebellum Anglo-America.¹ Although the past decade has produced a crippling assault on this thesis, I shall contend that recent critics misapplied the economic model, erroneously concluded that slavery was the most efficient agrarian labor system in North America, and incorrectly inferred that the North rejected slavery for ideological-moral reasons rather than economic ones. When these critics assumed the comparability of slave-free-labor efficiencies during a yearly time span, they unwittingly placed wage labor in an untenable position. Wage labor was competitive for part of a year but never on an annual basis. Farmers who needed labor for a few days, weeks, or months found the use of hired labor decidedly cheaper and more efficient economically than slaves. The decisive factor in the farmer's choice of either slave or free labor came down to the annual labor requirements of his staple crop: crops such as wheat, which required only a few weeks of attention, lent themselves to wage labor; whereas crops such as tobacco or cotton, which demanded sustained attention during a long growing season, lent themselves to slave labor. The introduction of these appropriate free-labor costs into a labor-efficiency model reveals that the geography of antebellum slavery and free labor conforms rather well to economic theory. Farmers and planters used the economically rational labor supply; and more specifically, northern farmers rejected slavery because it was less efficient than free labor, not because slavery was morally or ideologically repugnant.

The causal link between staple crops and labor supply is revealed most clearly where regions shift from one staple to another. Of special interest are those regions that changed from "few-day" staples to "multiple-day" staples, or vice versa, with the attendant adjustments in labor supply. Accordingly, this paper examines two regions of staple change: the tobacco-to-wheat transition on the eastern shore of Maryland during the eighteenth century, and the wheat-to-corn transition in the antebellum Lower Midwest. In Maryland, tobacco produced by slaves prevailed until the 1720's; but as wheat took hold, hired labor proved more efficient and gradually replaced slaves. Privately manumitted slaves swelled both the free black population and the general wage-labor force. Matters were reversed in the emerging corn belt of southern

* Earlier versions of this paper were presented at the Eastern Historical Geography Association meeting held at the University of Delaware in the fall of 1976 and to the History Seminar held at the University of Maryland Baltimore County. I am indebted to the participants in these sessions and to Franklin Mendels and Allan Bogue for their comments and suggestions.

¹ Until now, the economic interpretation of slavery and free labor has been sustained on argument more than on substantive evidence of labor efficiency. The best statement connecting plantation crops and slavery appears in Lewis C. Gray: *History of Agriculture in the Southern United States to 1860* (2 vols.; Peter Smith, Gloucester, Mass., 1958), Vol. 1, pp. 462-480. Also, see Robert Baldwin: *Patterns of Development in Newly Settled Regions*, *Manchester School of Econ. and Soc. Studies*, Vol. 24, 1956, pp. 161-179; and Douglass C. North: *Agriculture in Regional Economic Growth*, *Journ. Farm Econ. Proc.*, Vol. 41, 1959, pp. 943-951. A cogent review of the issues is in Stanley L. Engerman: *Some Considerations Relating to Property Rights in Man*, *Journ. Econ. Hist.*, Vol. 33, 1973, pp. 43-65.

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and central Ohio, Indiana, and Illinois. Wheat was the initial staple, produced by wage labor and by family farm members. But owing to the expansion of corn in the 1840's and 1850's, to the demanding cultivation requirements of corn as compared with wheat, and to rising wage rates, hired labor was steadily pushed into economic competition with slaves. The corn-hog region gave increasingly vocal support to proslavery politics, parties, and legislation and helped force through severely restrictive state laws that curtailed the civil rights of free blacks and led them toward servitude if not enslavement. Slavery was headed for the North in the wake of a corn economy; the only way to halt the laws of economics and preserve northern free labor was to destroy the peculiar institution in a civil war.

The economic interpretation of labor systems is controversial, and the wise course is to proceed cautiously. I begin by briefly reviewing the economic model of labor choice and the critics of an economic interpretation before I turn to the refined staple model and to the two regions of study.

LABOR: SLAVE OR FREE

Interpretations of slavery and free labor, whether economic or noneconomic, begin at the same place: the calculation of relative labor efficiencies. The rational capitalist farmer, faced with a choice of slavery or free labor, chooses in accordance with Evsey Domar's model of labor profitability.³ The farmer compares outputs and costs of slaves and freemen and uses the labor supply that offers the greatest return. Stated more generally, the farmer prefers free labor when $P_f - P_s > W_f - W_s$, where P_f is the net average productivity of free labor, P_s is the net average productivity of slave labor, W_f is the cost of free labor, and W_s is the subsistence and discounted costs of slave labor. The model is simplified when slave and free-labor outputs are shown as equivalent or nearly so, in which case labor choice becomes a matter of least cost, and free labor is used when $W_s > W_f$. Domar, though he did not test his model with data from the United States, speculated that such a test would probably show slavery as the most efficient labor supply for the entire nation; and, therefore, northern rejection of slavery must be interpreted on noneconomic grounds. Yet Domar was ambivalent. As an economist, he knew that if his hunch proved correct, it would seriously undermine economic rationality as a behavioral model.

I know of two tests of Domar's model, albeit crude ones. Each sustains his hunch about the economic superiority of slavery. In 1967, Arthur Zilversmit presented a double-barreled argument on northern labor before 1800.³ First, he concluded that slave and free-labor outputs were similar, thus casting doubt on the assumption that the incentive of freedom resulted in greater productivity than slavery. Recently and independently John Hicks reached the same conclusion on theoretical grounds.⁴ Having set productivities equal, Zilversmit turned to the cost side, compared slave prices with white servant prices and annual free wage rates, and concluded plausibly

³ Evsey Domar: *The Causes of Slavery or Serfdom: A Hypothesis*, *Journ. Econ. Hist.*, Vol. 30, 1970, pp. 18-32. Economic historians have acknowledged Domar's contribution, but they have given too much attention to the land-labor ratio as a determinant of wage rates while disregarding empirical tests of the labor efficiency model. Wage labor can be used in societies with high land-labor ratios, as will be pointed out below.

³ Arthur Zilversmit: *The First Emancipation: The Abolition of Slavery in the North* (Univ. of Chicago Press, Chicago, 1967), pp. 33-53. Also, Leon F. Litwak: *North of Slavery: The Negro in the Free States, 1790-1860* (Univ. of Chicago Press, Chicago and London, 1961), pp. 3-29.

⁴ John Hicks: *A Theory of Economic History* (Clarendon Press, Oxford, 1969), pp. 122-140.

that slaves, when the costs were discounted over their useful lives, were much less expensive than either wage labor or servant labor. Although more refined economic calculations might increase Silversmit's slave costs, his conclusions that slavery was the most efficient labor system and that its abolition in the North was rooted in ideology, morality, and ethics remain unshaken.

Domar and Silversmit weakened the economic interpretation of labor, but the most damaging blow was delivered long ago, in 1795. In that year, William Strickland tried to prove that slavery was a poor economic choice in Virginia, but his evidence showed just the opposite: slaves cost less than free labor not only in Virginia but in all of the United States as well.⁶

Strickland's method was straightforward. The Englishman believed the Virginia planters' lament that slaves entailed excessive costs and low returns. He set out to verify these complaints by attacking the cost side of Domar's equation, confident that slaves would cost much more than free labor. Using records of construction costs of the James River Canal, Strickland calculated slave costs at £18 a year, which consisted of annual hire rates for adult male slaves of £9 plus maintenance costs of £9. He then computed daily slave cost at 1s. 2d. and compared this figure with Chesapeake free-labor day rates. Much to Strickland's disappointment, slaves cost the planters less than free whites, who hired out at 1s. 6d. a day. In fact, the cost advantage to slavery was much greater than Strickland's estimates because of his biased accounting. Specifically, slave maintenance costs of £9 are very high, and a more realistic estimate on the order of £3 to £6 a year drives down daily slave costs to 9s. 4d. or 11s. 7d., respectively. These figures make the costs of slaves lower than the costs of either free Negroes or free whites. Slavery won on the cost side in Virginia and also in the northern states, where free labor received 1s. to 2s. per day, according to Strickland's own estimates.

Strickland persisted in pressing his thesis of the economic inferiority of slavery. Having lost on the cost side, he launched a vicious attack on slave output—Domar's productivity. Slaves were depicted as inert, recalcitrant, slovenly, and prone to willful destruction and pilfering. Given these traits, Strickland concurred with "the received opinion of the country, that slave-labour is much dearer than any other; and that the price paid for the *time* of a slave, by no means shows the amount of value of his labour; it certainly is much higher than it appears to be; though not knowing the quantity of labour performed by slaves in general in a given time, in a sufficient number of instances, I have not data whereon to calculate the exact value."⁶ This tactic will not do.

Low slave productivity cannot be inferred from Strickland's exaggerated stereotype of black behavior. Slaves may have been at times lazy, slovenly, and subversive in the fields, but the evidence we have from colonial America suggests that white freemen behaved in similar ways;⁷ and furthermore, measures of physical productivity thus far assembled show no appreciable differences in output between white and black, or slave and free. For instance, Chesapeake tobacco growers between 1660 and

⁶ William Strickland: *Journal of a Tour in the United States of America, 1794-1795*. With a Facsimile Edition of William Strickland's "Observations on the Agriculture of the United States of America" (edited by J. E. Strickland; New-York Hist. Soc., New York, 1971), pp. 31-36.

⁷ *Ibid.*, pp. 33-34.

⁸ See, for example, David Bertelson: *The Lazy South* (Oxford Univ. Press, New York, 1967); and Edmund S. Morgan: *American Slavery American Freedom: The Ordeal of Colonial Virginia* (W. W. Norton & Company, Inc., New York, 1975).

1770 consistently produced between 1,500 and 2,200 pounds per year per laborer, and slaveholding planters produced more tobacco than those planters without slaves.⁸ Nor is there any compelling reason for believing that free labor produced more corn or wheat than slaves, per unit of labor input.⁹ In short, Strickland's invective against the productivity of slaves must be dismissed. The rest of his argument supports the Domar-Zilversmit thesis that northern farmers who hired free labor chose an inefficient labor force.

The economic interpretation of American slavery and free labor, long sustained by tradition and faith, is in shambles as a result of these recent studies. The suggestion that northern farmers used an inefficient labor supply is subtly shifting the attention of economic history and historical geography from South to North and from economic to noneconomic explanations of northern free labor. The issue is not why the South used slaves but why the North did not use them.¹⁰ In the remainder of this essay I address the borderland between North and South, where both slaves and free labor were accessible. Careful consideration of this borderland reveals flaws in the revisionist inefficiency thesis, while refining and clarifying the staple economic basis of labor choice.

A STAPLE ECONOMIC INTERPRETATION OF LABOR SYSTEMS

Domar's labor efficiency model will explain the geography of labor, provided that labor inputs of freemen and slaves are compared fairly. Returning to that model, let us assume that slave and free-labor outputs are equivalent—a point suggested by the evidence cited above. Entrepreneurs select the labor supply by comparing costs and choosing the least expensive, such that they use slaves when $W_s < W_f$ and free labor when $W_f < W_s$. All this is easy enough; the tough problem is assessing the comparable costs. Heretofore, slave-labor and free-labor costs have been assessed as though each group were employed for a whole year. Such a procedure, while appropriate for slaves as permanent fixtures, has the effect of vastly inflating the costs of hired labor, customarily employed by the day or for several weeks or months but rarely by the year. During these short terms hired labor was competitive with slaves, as long as the number of days of hired labor times the daily wage rate was less than the cost of a slave.

It is precisely at this point that staples play a decisive role by regulating the amount of required labor days. During the growing season, staples vary remarkably in their daily demands for labor. The time-honored distinction between plantation crops and small grains reflects these differences in labor requirements. Plantation crops, such as tobacco, cotton, and wet rice, are so called because they are planted separately and command individual attention by labor during the growing season,

⁸ Carville V. Earle: *The Evolution of a Tidewater Settlement System: All Hallows' Parish, Maryland, 1650-1783*, Univ. of Chicago, Dept. of Geography, Research Paper No. 170, Chicago, 1975, pp. 24-27.

⁹ "I have a hard time believing that slaves could not be used in the mixed farming of the North; much food was produced on southern farms as well, most of the slave owners had very few slaves, and many slaves were skilled in crafts" (Domar, *op. cit.* [see footnote 2 above], p. 30).

¹⁰ Domar urged this refocusing in 1970, but so far the "new" economic historians have disregarded the problem of slave-free labor efficiencies under the same crops and have instead directed their attention to the efficiencies of farms and plantations. These are not the same, as is forcefully pointed out in Paul A. David and Peter Temin: *Slavery: The Progressive Institution? in Reckoning with Slavery* (by Paul A. David, Herbert G. Gutman, Richard Sutch, Peter Temin, and Gavin Wright; Oxford Univ. Press, New York, 1976), pp. 165-230, reference on pp. 202-203.

especially during cultivation.¹¹ Their frequent and even demands for labor invariably drove up wage labor costs beyond slave costs. By contrast, broadcast grains such as wheat demand labor in concentrated applications. Wheat labor worked sunup to sunset during fall planting and midsummer harvest, but no labor was required between these periods.¹² The economically rational antebellum wheat farmer almost always employed wage labor because the few days of labor required times the daily wage rate usually fell below the cost of slaves.

The plantation-small grain dichotomy, though traditional, confuses the main issue: how many days of attention the staples require during the crop season. Theoretically, the number of days of attention ranges from one to three hundred and sixty-five, and the appropriate dichotomy is thus between few-day and multiple-day crops. For instance, dairy farming, though never regarded as a plantation crop, demands labor during the entire year and is as much a multiple-day staple as plantation cotton or tobacco. Might this fact not explain the otherwise anomalous use of slaves in the dairying zone of colonial Narragansett, Rhode Island?¹³ To cite another example, corn requires labor days intermediate between the extremes of wheat and cotton or dairying. The extensive labor demands of corn during the three-to-four month period of plowing and tillage made it adaptable to slaves or freemen, depending on wage rates and slave costs.¹⁴ Using the "required-days" approach suggested here, we may achieve a more realistic assessment of wage costs that faced the farmer who chose between slaves and freemen.

A caveat is in order. Staple labor days are not to be confused with labor intensity. For example, two crops that use equivalent acreage and require identical labor inputs of 300 man-hours may have different allocations of labor during the growing season. One crop may be tended in just thirty days, for ten hours a day, while the other requires seventy-five days at four hours a day. Under prevailing wage rates and slave costs in pre-1860 Anglo-America, the former favored freemen, the latter slaves.¹⁵

At this point, Domar's model can be refined for free labor by restricting comparison to similar staples. Farmers will choose free labor when $W_f D_i < W_s$, where W_f is the wage rate of free labor and D_i represents the labor days required by the staple.

¹¹ Gray, *op. cit.* [see footnote 1 above], Vol. 1, pp. 462-480; and Baldwin, *op. cit.* [see footnote 1 above], pp. 161-179.

¹² "Our winter crops of wheat, barley, & c. also the oats flax & buckwheat are so disposed of as to require no further care [until harvest] after the seeds are put into the ground" (R. O. Bausman and J. A. Munroe, eds.: James Tilton's Notes on the Agriculture of Delaware in 1788, *Agric. Hist.*, Vol. 20, 1946, pp. 176-187, reference on p. 181). See also Peter Kalm: *Travels into North America* (The Imprint Society, Barre, Mass., 1972), p. 77; and John H. Klippart: *The Wheat Plant: Its Origin, Culture, Growth, Development, Composition, Varieties, Diseases, etc., etc. Together with a Few Remarks on Indian Corn, Its Culture, etc.* (Moore, Wiltach, Keys, Cincinnati, Ohio, 1860), pp. 475-478.

¹³ Percy Wells Bidwell and John I. Falconer: *History of Agriculture in the Northern United States, 1620-1860* (Peter Smith, New York, 1941), pp. 106 and 109-110.

¹⁴ Bausman and Munroe, *op. cit.* [see footnote 12 above], p. 181; Robert Russell: *North America, Its Agriculture and Climate; Containing Observations on the Agriculture and Climate of Canada, the United States, and the Island of Cuba* (A. and C. Black, Edinburgh, 1857), pp. 81-82; and Allan G. Bogue: *From Prairie to Cornbelt: Farming on the Illinois and Iowa Prairies in the Nineteenth Century* (Quadrangle Books, Chicago, 1968), pp. 132-133.

¹⁵ Economists have generally regarded labor inputs in terms of intensity (man-hours or man-days); hence systematic data on the more critical labor input of "required days" are lacking. These data are available, however, in sensitive accounts by agricultural historians. See Bogue, *op. cit.* [see footnote 14 above], pp. 132-133; Gray, *op. cit.* [see footnote 1 above], Vol. 1, pp. 462-480; and Paul W. Gates: *The Farmer's Age: Agriculture, 1815-1860* (Harper & Row Publishers, New York, Evanston, and London, 1960).

STAPLES AND LABOR IN THE COLONIAL CHESAPEAKE

Staple change and labor adjustments in the eighteenth-century Chesapeake lend empirical support to this theoretical discussion. Wheat supplemented and then replaced tobacco as the staple of Maryland's upper eastern shore during the period between 1720 and the Revolution. Although the details of regional economic change demand much more elaboration, the outline of changes in staples and labor is fairly clear.¹⁶ The clayey soils of that region produced a poorer quality tobacco which was less valuable than western shore crops. As grain prices rose after 1720, reflecting demands from southern Europe and the West Indies, slave-owning tobacco planters on the upper eastern shore rationally shifted to grains, especially wheat. This new few-day staple also entailed adjustments in the labor supply. Some slaves were hired out for short terms; others functioned as sharecroppers; and still others were emancipated by their owners. Manumission was abetted, of course, by Quaker abolitionists and revolutionary egalitarianism, but the rock-bottom cause was economic. Wheat was produced more efficiently with freemen than with slaves.¹⁷

An example may clarify the economic pressures on the average planter during the middle of the eighteenth century. On the typical tobacco plantation one laborer produced 1,000 pounds of tobacco on about three acres. Total labor input was about 185 man-hours, or 23 man-days. More decisive from the standpoint of labor was the number of days of labor attendance required by tobacco, which amounted to as many as 75 days spread over the January-to-November cropping season. The planter who hired free labor at a wage rate of 3s. a day paid out £11 5s.¹⁸ Using slaves effected a considerable savings. A prime male slave field hand cost £5 10s. a year, calculated by using an average slave price of £50 discounted over a useful life of twenty years, or £2 10s. a year, plus annual maintenance costs of £3.¹⁹ Tobacco planters chose slaves for the simple reason that they cost less than half of what free labor cost.

¹⁶ This discussion of economic change on the eastern shore derives from many sources, too numerous to be listed here. See especially Carville Earle and Ronald Hoffman: *Staple Crops and Urban Development in the Eighteenth-Century South, Perspectives in Amer. Hist.*, Vol. 10, 1976, pp. 7-78; and Paul G. E. Clemens: *From Tobacco to Grain: Economic Development on Maryland's Eastern Shore, 1660-1750* (unpublished Ph.D. dissertation, Dept. of History, Univ. of Wisconsin, Madison, 1974).

¹⁷ On manumission and free blacks on the eastern shore, see the impressive study by Ira Berlin: *Slaves without Masters: The Free Negro in the Antebellum South* (Vintage Books, New York, 1974), pp. 15-78. Also, Kenneth L. Carroll: *Religious Influences on the Manumission of Slaves in Caroline, Dorchester, and Talbot Counties, Maryland Hist. Mag.*, Vol. 56, 1961, pp. 176-197; and *idem*, *Maryland Quakers and Slavery, ibid.*, Vol. 45, 1950, pp. 215-225. These studies emphasize religion and revolutionary ideology as the chief causes of manumission and the growth of the free black community; yet these interpretations fail to explain the strength of slavery sentiment among tobacco-producing Quakers on Maryland's western shore and the manumission activity that began before the Revolution. In 1790, the proportion of free Negroes to all Negroes was highest in the upper bay counties of Maryland ("Return of the Whole Number of Persons within the Several Districts of the United States, According to 'An Act Providing for the Enumeration of the Inhabitants of the United States,' Passed March the First, One Thousand Seven Hundred and Ninety-One" [Childs and Swaine, Philadelphia, 1791], p. 47). On slave hire and hire rates, see Strickland, *op. cit.* [see footnote 5 above], pp. 31-36; and "Letters of Father Joseph Morley, S.J., and Some Extracts from his Diary (1757-1786)," *Records Amer. Catholic Hist. Soc.*, Vol. 17, 1906, pp. 180-210 and 289-311, especially p. 300.

¹⁸ These estimates, their sources, and a preliminary, if crude, statement of the argument made here appear in Earle and Hoffman, *op. cit.* [see footnote 16 above], pp. 36-39 and 68-78.

¹⁹ Slave prices appear in Clemens, *op. cit.* [see footnote 16 above], p. 171; "Historical Statistics of the United States, Colonial Times to 1970" (2 parts; Bur. of the Census, Washington, D.C., 1975), Part 2, p. 1174; Allan Kulikoff: *Tobacco and Slaves: Population, Economy and Society in Eighteenth-Century Prince George's County Maryland* (unpublished Ph.D. dissertation, Dept. of History, Brandeis Univ., Waltham, Mass., 1976), pp. 485-488; and Harry J. Carman, edit.: *American Husbandry* (Kennikat Press, Port Washington, New York, 1964), p. 164. Twenty years as the useful life for adult male slaves for discounting

Conversely, assume that wheat became more profitable and that the planter turned to farming. His slave prepared and sowed ten acres in August and September, and harvested 100 bushels from this land the following July. The labor input of about 25 man-days for wheat resembled that for tobacco; but wheat required a mere 25 days in attendance, one-third the attendance requirement of tobacco. Slave costs in wheat remained the same as in tobacco, £5 10s., but hired labor costs, at 25 days times 3s. per day, fell to £3 15s. For the wheat farmer, wage labor was decidedly cheaper than slaves, by £1 15s.²⁰

These cost savings resulted in substantial productivity gains for free labor in wheat. A farmer who invested his savings of £1 15s. in additional day labor gained 12 labor days in wheat production. Put differently, the farmer expanded wheat output from 100 bushels to nearly 150 bushels—a gain of 50 percent over slave output. This superior productivity of free labor in wheat resulted, therefore, from cost savings to free labor and from the divisibility of its labor inputs, such that labor could be hired in small daily increments. On the other hand, this productivity had little or nothing to do with the output incentives mythically attached to the condition of freedom.²¹

The unique harvest regimen of wheat gave a divisible labor supply another advantage. The maturation of wheat allowed only about ten days in July for harvest. As the grain passed quickly through the dough or harvest stage, the seeds became dead ripe, shattered, and fell to the ground as reaped. Reaping at the maximum rate of an acre a day, a slave was hard-pressed to finish ten acres of wheat. Wage labor assured that the harvest would be completed on time. Instead of hiring one laborer for ten days, the farmer might hire two men for five days, thus minimizing the loss of grain by overripening and shattering.²²

Slaves and wheat made an unhappy marriage on Maryland's eastern shore. Slaves were more expensive and less productive than wage labor, and pressures for adjustments from slaves to hired labor were inevitable. After 1750, slave owners pursued several alternatives: slaves were hired by the day or week during the harvest bottleneck; sharecropping schemes were suggested to reduce slave costs while keeping available a harvest labor force; and private manumission of slaves increased. Although these adjustments toward free labor are the most important changes, the range of solutions was limited only by the ingenuity of individual planters as they sought to wed staples and labor supply.²³

The changeover from slaves to free labor on the eastern shore was excruciatingly slow; yet we have no reason to expect instantaneous labor adjustment to the economic model. In the first place, although slaves had become decidedly inefficient, they nonetheless involved a heavy sunk cost not easily recouped. More decisively, whole-

purposes is suggested in Carman [see above], p. 164; and Clemens, *op. cit.* [see footnote 16 above], pp. 47-53. However, calculating slave life expectancy is an intractable problem. Among Prince George's County whites in the eighteenth century, expectation of life at age 20 was 27 additional years (Kulikoff [see above], pp. 38-41). Maintenance costs are from Carman [see above], p. 164.

²⁰ Earle and Hoffman, *op. cit.* [see footnote 16 above], pp. 68-78.

²¹ The belief that freedom was a production incentive and resulted in productivity gains over slavery probably rests on free labor's superior output in broadcast grain production—a superiority we have attributed to the few required days of labor and the divisibility of free labor. The incentive of freedom disappeared in tobacco production, where a slave doubled the output of freemen for a given cost.

²² Klippart, *op. cit.* [see footnote 12 above], pp. 475-478; and Leo Rogin: *The Introduction of Farm Machinery in Its Relation to the Productivity of Labor in the Agriculture of the United States During the Nineteenth Century* (Univ. of California Press, Berkeley, 1931), p. 78.

²³ Berlin, *op. cit.* [see footnote 17 above], pp. 15-78; Carroll, *Religious Influences* [see footnote 17 above], pp. 176-197; Letters of Father Joseph Morley [see footnote 17 above], p. 300; and Strickland, *op. cit.* [see footnote 5 above], pp. 31-36.

sale labor change involved the risk that sudden changes in relative labor costs or in the technology of staple production could turn against free labor. For instance, slaves could have produced wheat at less cost than free labor if the wheat harvest was extended by rescheduling planting, if free wage rates rose, or if slave costs fell. Crop scheduling appealed to George Washington, and no doubt eastern shore farmers tried it. By planting fall wheat at staggered intervals or by sowing several varieties, the fields might mature at different times and spread the harvest over more than ten days. Washington then saw how slaves could be used to advantage: "if Wheat of different kinds are sowed so as to prevent the Harvest coming on at once, it is my opinion that hirelings [wage labor] of all kinds may be dispensed with."²⁴ Using our previous calculations, free labor probably handled fourteen to fifteen acres and slaves ten acres; accordingly, expanding the wheat harvest beyond fifteen days, at one acre harvested a day, would have resulted in a clear-cut advantage for slave labor. Fortunately for northern free labor, Washington's cropping scheme was never successfully implemented, as John H. Klippart observed nearly a century later,²⁵ and almost two centuries passed before Warren Thornthwaite worked out the intricacies of crop calendars.

A second condition that favored slave-produced wheat was higher wage rates. In 1769, when Washington toyed with crop scheduling, wheat was in great demand, prices were high, and a bumper crop drove wages up. Day wages rose from a norm of 3s. to 5s. a day for skilled harvesters.²⁶ At that rate, ten acres of wheat production cost £6 5s., compared with £5 10s. for a slave. Understandably, slave owners were reluctant to free their slaves until they were assured of a steady, abundant, and low-cost supply of free labor. The year 1769 was atypical, however. Although similar wage peaks hit sporadically through 1860, wage costs generally remained relatively lower than slave costs. When the situation occasionally reversed, farmers supplemented the supply of free labor with marginal lower-cost laborers such as convicts or free Negroes.²⁷

Thirdly, wheat farmers would have used slaves if slave costs had fallen; indeed, theory implies such an adjustment and the mechanisms responsible. Assuming a single region in which wheat is produced, the demand curve for slaves shifts downward as slave inefficiencies in wheat production are perceived. While slave prices, and hence discounted costs, are falling, slave masters simultaneously may reduce maintenance costs by cutting expenditures for food, health care, clothing, and shelter.²⁸ In practice, however, such cost adjustments by markets and masters seem to have been blunted because of external markets for slaves. Prices for Chesapeake slaves rose rather than fell, suggesting that lower slave demand on the eastern shore was compensated by augmented demand from the expanding tobacco economy of the western shore. The existence of this neighboring slave market thus was decisive in

²⁴ George Washington: The Diaries of George Washington, 1748-1799 (edited by J. C. Fitzpatrick; 4 vols.; Houghton Mifflin Company, Boston and New York, 1925), Vol. 1, p. 338, cited in Gray, *op. cit.* [see footnote 1 above], Vol. 1, p. 550.

²⁵ Klippart, *op. cit.* [see footnote 12 above], pp. 475-478.

²⁶ Gaspar John Saladino: The Maryland and Virginia Wheat Trade from Its Beginnings to the American Revolution (unpublished M.A. thesis, Dept. of History, Univ. of Wisconsin, Madison, 1960), p. 45; Bidwell and Falconer, *op. cit.* [see footnote 13 above], pp. 117-118; and Historical Statistics, [see footnote 19 above], Part 2, p. 1196.

²⁷ In the antebellum Midwest, free Negroes were used principally during bumper harvests (David E. Schob: Hired Hands and Plowboys: Farm Labor in the Midwest, 1815-1860 (Univ. of Illinois Press, Urbana, Chicago, and London, 1975), pp. 83-87).

²⁸ This argument appears in Richard Sutch: The Profitability of Ante Bellum Slavery—Revisited, *South. Econ. Journ.*, Vol. 31, 1965, pp. 365-377, reference on pp. 365-366.

propping up eastern shore slave prices and costs, despite slave inefficiencies in wheat. Put pithily, freedom on the eastern shore depended on the existence of slavery in a nearby region. The market failed to make slaves competitive with free labor, but masters had another avenue by lowering maintenance costs. Whether they proceeded ruthlessly by reducing medical care, housing, and clothing of slaves or by affording quasi-freedom via sharecropping and eventual manumission remains an issue of overriding importance.²⁹

Slavery lost out in the wheat-producing eastern shore precisely because none of these three conditions—harvest extension through crop scheduling, rising wage rates, or declining slave costs—seems to have been met. For these reasons, a few-day crop such as wheat fostered the development of a labor force that was free, flexible, and divisible in its inputs.

STAPLES AND LABOR IN THE ANTEBELLUM MIDWEST

Slavery decayed, albeit slowly, on Maryland's eastern shore with the change from tobacco to wheat. But what of the reverse situation, where few-day wheat gave way to a multiple-day crop? The test case here comes from the antebellum Midwest and deals with the transition from wheat to a corn-hog complex that took place just before the Civil War. This staple change posed a momentous threat to northern wage labor in particular and to society in general. I begin at a more mundane level by comparing the costs of slave labor and free labor under wheat and its successor, Indian corn. Having demonstrated slave efficiency in corn production, I turn to proslavery attitudes and legislation in the Midwest.

Antebellum labor costs provide the basic economic information. Slave costs are from Alfred H. Conrad and John R. Meyer's estimate of \$51 as the annual cost of a slave between 1830 and 1850. They arrive at this figure by first discounting the price of a twenty-year-old male slave (\$900 to \$950) over a useful life of thirty years, or \$30, and adding yearly maintenance costs of \$21 for a total of \$51.³⁰ Farm-labor wages come from Stanley Lebergott's wage series for the various states under consideration.³¹ Comparison of slave and wage costs from these sources show that wage labor hired by the year was expensive and could not compete with slaves. For example, in 1830 the average monthly wage in the United States of \$8.85 totaled \$95.20 for twelve months—almost double the cost of a slave.³² These figures cast serious

²⁹ On slave prices, see Clemens, *op. cit.* [see footnote 16 above], p. 171; Historical Statistics, [see footnote 19 above], Part 2, p. 1174; and Kulikoff, *op. cit.* [see footnote 19 above], pp. 485–488. These prices are not entirely satisfactory, for we need a series specifically for the eastern shore after 1750. However, rather high slave prices are suggested in Letters of Father Joseph Morley [see footnote 17 above], p. 300. Slave clothing allowances, as an indicator of maintenance costs, seem to have remained the same from the 1720's to the Revolution, but the evidence is fragmentary (Clemens, *op. cit.* [see footnote 16 above], pp. 47–53 and 175).

³⁰ Alfred H. Conrad and John R. Meyer: *The Economics of Slavery in the Antebellum South*, in *The Reinterpretation of American Economic History* (edited by Robert W. Fogel and Stanley L. Engerman; Harper & Row, Publishers, New York, Evanston, and elsewhere, 1971), pp. 342–361, especially pp. 345–347. The farmer who was considering the adoption of slavery would probably have purchased a prime male field slave rather than an infant or child slave; hence the appropriate costs are given by slave market prices rather than the considerably lower costs of slave reproduction and rearing. For the latter costs, see Yasukichi Yasuba: *The Profitability and Viability of Plantation Slavery in the United States*, *Econ. Studies Quart.*, Vol. 12, 1961, pp. 60–67.

³¹ Stanley Lebergott: *Manpower in Economic Growth: The American Record since 1800* (McGraw-Hill Book Company, New York, Chicago, and elsewhere, 1964).

³² Monthly wages are with board included (*ibid.*, p. 539).

doubt on Clarence H. Danhof's belief that freemen were commonly hired for eight to ten months during the cropping season; eight months of labor in 1830 cost more than \$70, still far in excess of slave costs.³³ Long labor contracts of this sort were used selectively, notably during the first years of farm making and sod busting; but otherwise the eight-to-ten-month laborer cost too much. Other students of farm labor lean toward shorter-term hire, ranging from a daily basis to several months at a time; and their impressions and evidence conform remarkably well with the hypothesis of labor costs presented here.³⁴ Given the prevailing wage rates in midwestern states in 1830, three to five months was the theoretical maximum for wage-labor hire; beyond that time, slaves became cheaper than freemen. Parenthetically, we may note that free labor had improved its economic position vis-à-vis slaves between 1750 and 1850. In the earlier year, the annual cost of a slave equaled about 36 days of wage labor as compared with 65 days of hired labor in 1830 Ohio.

Wheat was the initial staple of the Midwest, and its labor requirements fell easily within the economic range of free labor. The link between day labor and wheat should be clear from the earlier discussion of the Maryland case, and repetition for the Midwest is unnecessary. However, subtle changes in nineteenth-century wheat production gave day labor even greater advantages. The harvest-labor bottleneck of ten days to two weeks persisted into the nineteenth century, but labor demands became even more intense because farmers increased output per acre from the colonial norm of ten bushels to twenty to thirty bushels or more. Accordingly, labor time spent in harvesting and gathering the wheat, despite some efficiencies introduced by the cradle and the flail, increased from 60 percent of total labor time to about 83 percent in the prereaper nineteenth century. Harvesting and getting in an acre of wheat, according to Leo Rogin, required about five days.³⁵ That meant that a slave could harvest just two to three acres of wheat, while divisible day labor, hired at the 1830 Ohio wage rate for the time equivalent of a slave's cost and allocating five-sixths of the hired labor to harvest, handled ten or eleven acres of wheat. In other words, a slave harvested and gathered two to three acres for \$51.00, or a cost of \$17.00 to \$25.50 per acre. Day laborers, paid \$51.00, harvested and gathered ten to eleven acres, at a cost of \$4.64 to \$5.10 per acre. Furthermore, day laborers cost less than monthly labor. The hire of two laborers for three months each cost \$66.00 at the 1830 Ohio rate; and they harvested and gathered four to six acres, at a cost of \$11.00 to \$16.50 per acre.³⁶

As long as wheat persisted as the midwestern staple, day labor was economically superior to both slaves and monthly hired hands. Nor did this superiority of the day

³³ Clarence H. Danhof: *Change in Agriculture: The Northern United States, 1820-1870* (Harvard Univ. Press, Cambridge, Mass., 1969), pp. 73-78. This criticism should not impugn the remainder of this excellent and essential book.

³⁴ Bogue, *op. cit.* [see footnote 14 above], pp. 182-187; Merle Curti: *The Making of an American Community: A Case Study of Democracy in a Frontier County* (Stanford Univ. Press, Stanford, Calif., 1959), pp. 145-149; Paul W. Gates: *Frontier Estate Builders and Farm Laborers*, in *The Frontier in Perspective* (edited by Walker D. Wyman and Clifton B. Kroeber; Univ. of Wisconsin Press, Madison, 1957), pp. 143-164; and Schob, *op. cit.* [see footnote 27 above], pp. 69, 103-104, and 238.

³⁵ Rogin, *op. cit.* [see footnote 22 above], pp. 229-243; and Gates, *Farmer's Age* [see footnote 15 above], pp. 156-169. See also Paul A. David: *The Mechanization of Reaping in the Ante-bellum Midwest, in Industrialization in Two Systems: Essays in Honor of Alexander Gershenkron by a Group of His Students* (edited by Henry Rosovsky; John Wiley & Sons, Inc., New York, London, and Sydney, 1966), pp. 3-39.

³⁶ The discussion, of course, concerns prereaper harvest technology. I have used the 1830 Ohio daily hire rate, without board, of \$0.78 and the monthly hire rate, with board, of \$11.00 (Lebergott, *op. cit.* [see footnote 31 above], p. 539; and Schob, *op. cit.* [see footnote 27 above], p. 259). Somewhat higher daily rates of \$1.27 for 1849-1853 have been recorded in Illinois, particularly for harvest cradlers (David, *op. cit.* [see footnote 35 above] pp. 35-37).

hand diminish with increased scale of operation—a point demonstrated later in the century in the bonanza wheat farms of the Red River Valley, where day laborers at the critical seasons vastly outnumbered laborers hired by the month or season.³⁷

The midwestern staple economy altered between 1800 and 1860, and pressures to adjust the labor supply became evident a decade or two before the Civil War. The wheat staple suffered from disease and humidity, particularly in the south central tier of Ohio, Indiana, and Illinois; and as wheat became less attractive, the southern demand for hogs and pork encouraged a corn-hog staple economy. Wheat was supplemented and then displaced by these new regional staples.³⁸ From the standpoint of labor requirements, corn lay intermediate between wheat's few days and the multiple labor days of tobacco and cotton. More precisely, a laborer in corn tended about twenty-five acres and invested perhaps 850 man-hours, compared with wheat's ten acres and 600 man-hours.³⁹ From plowing through the third cultivation the individually planted and tended corn plant demanded exceptional attention. The corn farmers of Illinois, for example, planted in April or early May and cultivated three times before July 4, when the crop was "laid by." Afterward, labor needs were light until harvest. Although corn harvesting was backbreaking and sweaty work, corn did not create a harvest labor bottleneck as did wheat. The crop was ready for harvest in September, but there was no urgency because the ears could stand in the fields throughout the winter and into early spring. As a result, corn was usually harvested by family members or neighbors during idle moments, rather than by expensive wage labor. Thus for corn it was the plowing and tillage in spring and early summer that established the period of peak labor demand.⁴⁰

Corn farmers sought labor for the three to four months from April or May through July. Day labor was prohibitively expensive, and corn farmers engaged labor on short-term contracts of ten weeks to four months.⁴¹ But this shift upward in labor costs pushed freemen into competition with slaves (it makes no difference that state legislatures and referenda had outlawed slavery in the Midwest in the first quarter of the century). For instance, an Illinois farmer who hired a four-month laborer with board in 1850 spent \$12.55 a month and \$50.20 for four months, whereas a slave would have cost the farmer \$51.00. Wage rates had risen by 1860, when the four-month laborer cost \$54.88.⁴² These wage rates, I might add, are conservative figures; David

³⁷ Fred A. Shannon: *The Farmer's Last Frontier: Agriculture, 1860-1897* (Harper & Row, Publishers, New York, Evanston, and London, 1968), pp. 154-161.

³⁸ Midwestern economic change is thoroughly discussed in J. E. Spencer and Ronald J. Horvath: *How Does an Agricultural Region Originate? Annals Assn. of Amer. Geogrs.*, Vol. 53, 1963, pp. 74-92. See also Bogue, *op. cit.* [see footnote 14 above], pp. 156-172; and John G. Clark: *The Grain Trade in the Old Northwest* (Univ. of Illinois Press, Urbana and London, 1966), pp. 147-171 and 197-211. Regional boundaries were hazy. The Lower Midwest continued to produce wheat after corn and hogs were the main staples. But toward the Great Lakes, wheat remained dominant and the corn-hog complex penetrated more slowly. See the maps of corn and wheat production in Charles O. Paullin: *Atlas of the Historical Geography of the United States* (edited by John K. Wright; Carnegie Inst. of Washington and the Amer. Geogr. Soc. of New York, Washington, D.C. and New York, 1932), Plate 143.

³⁹ Shannon, *op. cit.* [see footnote 37 above], p. 143.

⁴⁰ Russell, *op. cit.* [see footnote 14 above], pp. 81-82; and Bogue, *op. cit.* [see footnote 14 above], pp. 132-133.

⁴¹ "The general practice in Central Illinois is to hire about the 1st of April for the 'crop (corn) season,' or until after harvest, which includes wheat, oats, hay, & c." (*The Merchants' Magazine and Commercial Rev.*, Vol. 41, 1859, p. 760.) The small grain harvest was in July, so the author meant that labor was hired from April to the end of July, or for four months. Also, see Russell, *op. cit.* [see footnote 14 above], pp. 81-82.

⁴² Lebergott, *op. cit.* [see footnote 31 above], p. 539. The labor problem was most severe between 1854 and 1857, when wage rates peaked. David shows that Illinois common laborers received \$1.25 a day compared with \$0.85 in 1849-1853—an increase of 35 percent. Adjusting our monthly rates according to this

E. Schob has indicated that the four-month rate may have been \$13.00 to \$18.00 a month rather than \$12.55.⁴³ By the mid-1850's, slave labor probably was less costly than free labor in the production of corn, a multiple-day staple crop.⁴⁴ To make matters worse, slaves had long since mastered the techniques of corn production, and they employed these in Kentucky, just across the river from freedom.

The political implications of this analysis are far-reaching. As slavery became more efficient than free labor, we should and do find an acceleration of proslavery advocacy and legislation emanating from the central and lower midwestern corn region during the 1840's and 1850's. Slavery was headed north. The threat was no more nor less than the imminent dissolution of northern society based on free labor. Slavery took on a new urgency, and its enemies, so disarrayed before 1850, molded a unified opposition, focused on the northern margins of the corn belt. Their choice was simple: allow slavery to survive anywhere in the United States and corn farmers eventually would adopt the institution; destroy slavery completely and thus remove this labor supply as a competitor for freemen. The efficiency of slaves in corn culture helps put a new perspective on otherwise confused political behavior in the antebellum Midwest, to which we now turn.

The midwestern states in the first quarter of the nineteenth century prohibited the institution of slavery by referenda. This made economic sense because slavery was already a dead letter for the majority of farmers who produced a wheat staple and used more efficient free labor.⁴⁵ But these referenda posed an ominous threat: if laws and referenda could prohibit slavery, they could also introduce the peculiar institution when it became profitable. That day was not far off, as economic change swept over the Lower Midwest and as corn-hog farming supplemented or displaced wheat during the 1830's and 1840's. Slave costs still exceeded those of free labor, but the gap was narrowing. Accordingly, the corn region gave little support to the enemies of slavery; they found more fertile ground for their abolitionist societies, antislavery newspapers, and third-party efforts in the northern wheat counties. The sectional rift was apparent in the elections of 1844, 1848, and 1852, when the northern counties cast increasingly larger votes for antislavery third parties, while the nascent corn-belt counties voted overwhelmingly for the regular parties, particularly the Democrats.⁴⁶

percentage increase, we find that monthly wages would have risen from \$12.55 in 1850 to \$16.94 in 1854-1857, making a total wage bill of \$67.75. Slave costs fell below this (David, *op. cit.* [see footnote 35 above], p. 36).

⁴³ Schob, *op. cit.* [see footnote 27 above], p. 104.

⁴⁴ Slave costs rose during the 1850's but at a less rapid rate than free-labor costs. Slave prices moved up to \$1,306 between 1856 and 1860. Discounting this price over thirty years and adding \$21.00 for maintenance put slave costs at about \$64.50—or \$3.00 less than the four-month hire rate for free labor, as calculated in footnote 42. For slave prices, see Yasuba, *op. cit.* [see footnote 30 above], pp. 60-67. During the 1850's, midwestern real wages generally exceeded all other regions except the east south central states, thus compounding the pressure on free labor in this region (Philip P. Coelho and James F. Shepherd: *Regional Differences in Real Wages: The United States, 1851-1880, Explorations in Econ. Hist.*, Vol. 13, 1976, pp. 203-230).

⁴⁵ Eugene H. Berwanger: *The Frontier Against Slavery: Western Anti-Negro Prejudice and the Slavery Extension Controversy* (Univ. of Illinois Press, Urbana, Chicago, and London, 1967), pp. 7-29; Theodore Calvin Pease: *The Story of Illinois* (A. C. McClurg & Co., Chicago, 1925), pp. 96-113; and Jacob P. Dunn: *Indiana: A Redemption from Slavery* (Houghton, Mifflin and Company, Boston and New York, 1888).

⁴⁶ Theodore Clarke Smith: *The Liberty and Free Soil Parties in the Northwest* (Russell & Russell, New York, 1967), pp. 325-331; Paullin, *op. cit.* [see footnote 38 above], Plates 105, 114, and 115; and Arthur Charles Cole: *The Era of the Civil War, 1848-1870* (Illinois Centennial Commission, Springfield, 1919), pp. 101-201.

Northern support for third parties intensified when they added a new and powerful argument against slavery—an argument that becomes more reasonable when it is placed in the context of the increasing efficiency of slavery in the Lower Midwest. Salmon Chase and the Free-Soil party adopted all of the standard attacks on the immorality of slavery and on its exclusion from the territories, and they went even farther. Northern society, they proclaimed, faced the grave danger of an inexorably expanding slave power or slavocracy. Slavery threatened free labor, which was the underpinning for northern civilization. Chase's argument has been treated unkindly by political historians. Should we accept their verdict that he and his supporters were paranoid, grossly distorting the dangers of slave encroachment in the North, or crassly political, manipulating issues and voters through the use of exaggerated rhetoric and playing on the racial fears of midwesterners?⁴⁷ Quite the opposite, if the economic analysis presented here is correct. Chase was on sound ground; if he was guilty of anything, it was of detecting the threat of slavery to the North before more ordinary men and of misplacing blame on a conspiracy of expansionist-minded southern slaveowners instead of on a conspiracy of economics favoring the corn staple and pushing up wage rates in the late 1840's and 1850's.⁴⁸

Chase's argument did not win the day immediately. His fear that slavery would expand into the old Northwest was not shared by his natural allies in northern Illinois, Indiana, and Ohio. They faced a more pressing problem—control of an expanding free Negro population. Their anti-Negro attitudes, racism by another name, led them into an uneasy coalition with proslavery advocates in the corn belt. This coalition in the late 1840's and early 1850's voted repeatedly against free Negroes, excluding fugitive slaves and free Negroes from these states and circumscribing the civil and political rights of those who were already there. African colonization for midwestern free Negroes also held broad appeal.⁴⁹

The cement of racism began to crack in the mid-1850's. Upstaters who detested Negroes and wanted to get rid of them perceived that downstaters wanted to strip free Negroes of their rights in order to enslave them or else facilitate the introduction of slavery. The subtle schemes of proslavers were laid bare in an 1855 committee report of the Indiana legislature: African colonization, it claimed, originated "in the basest motives and most mercenary considerations. It is one of the offspring of slavery . . .

⁴⁷ See the perceptive examination of Chase in Eric Foner: *Free Soil, Free Labor, Free Men: The Ideology of the Republican Party before the Civil War* (Oxford Univ. Press, London, Oxford, and New York, 1970), pp. 73–102. Chase and other antislavery advocates are cast as irresponsible fanatics in Avery Craven: *An Historian and the Civil War* (Univ. of Chicago Press, Chicago and London, 1964). Benson has suggested that Chase and men of his persuasion were guilty of overblown campaign rhetoric and reckless demagoguery which got out of hand in the late 1850's. I disagree. See Lee Benson: *Toward the Scientific Study of History: Selected Essays of Lee Benson* (J. B. Lippincott Company, Philadelphia, New York, and Toronto, 1972), pp. 225–340, especially pp. 297–303.

⁴⁸ Foner's thesis that northern fears of an aggressive, expanding slave power played a decisive role in the coming of the war is pursued by Larry Gara: *Slavery and the Slave Power: A Critical Distinction*, in *Beyond the Civil War Synthesis: Political Essays of the Civil War Era* (edited by Robert P. Swierenga; *Contributions in American History No. 44*; Greenwood Press, Westport, Conn., and London, 1975), pp. 295–308. A leading advocate of corn culture, the midwestern Yankee Solon Robinson, produced a lengthy apologetic for slavery in *DeBow's Review* in 1849. The timing of his conversion, coming as it did when corn culture was expanding into the Lower Midwest and labor rates were rising, seems more than coincidental (Solon Robinson: *Negro Slavery at the South*, in Solon Robinson: *Pioneer and Agriculturalist* [edited by Herbert Anthony Kellar; 2 vols.; Indiana Hist. Bur., Indianapolis, 1936], Vol. 2, pp. 253–307).

⁴⁹ Berwanger, *op. cit.* [see footnote 45 above], pp. 30–39. For a slightly different view of midwestern racism, see John M. Rozett: *Racism and Republican Emergence in Illinois, 1848–1860: A Re-evaluation of Republican Negrophobia*, *Civil War Hist.*, Vol. 22, 1970, pp. 101–115.

intended to remove the free blacks from the country in order to increase the value and security . . . of slaves."⁶⁰ Even more drastic action had been taken by proslavers in Illinois. The legislature of 1853 put through a law that compelled free Negroes new to the state to pay a fine of \$50 plus court costs; Negroes unable to pay this exorbitant sum were hired out for six months to the highest bidder. Indiana carried a similar law on the books, and efforts to strengthen its provisions were narrowly defeated in 1851.⁶¹ That these laws favored black servitude, and potentially permanent bondage, did not escape the opponents of slavery. A delegate to Indiana's constitutional convention of 1850 clearly understood the implications of the attack on the free Negro.

If I am not mistaken the favorite proposition, and it has been already avowed and advocated here, is, that all persons in whose blood negro descent shall be detected, shall be arrested and sold for six months to the highest bidder and the proceeds applied to the operations of the Colonization Society! And what a spectacle will Indiana in that attitude present to the civilized world? We reprobate slavery and the slave trade, denounce the one as inhuman and the other as piracy punishable with death. And yet what is it proposed to do? Nothing less than to erect shambles at every county seat, enjoin it upon officers to sell, not slaves, but those who are confessedly free, into slavery, differing only from the Southern States, as to its duration.⁶²

Identical concern surfaced in Illinois, where the law of 1853 permitting court-appointed sale of free Negroes was regarded by some as a harbinger of slavery.⁶³

Proslavery efforts became more blatant as pressures for a more efficient slave labor supply emanated from the corn belt. Dumas Van Deren succinctly summarized the corn farmers' interests in 1854. He and other Illinoisians were

prepared to pronounce openly our full and candid preference in favor of slave labor in agricultural business. . . . We have discovered that the novelty of free labor is a mere humbug. . . . We have been endeavoring to learn the sentiments of our people upon this subject, and have been astonished to see with what unanimity they express themselves in favor of the introduction of slave labor. I have conversed with many of our best farmers who were raised in the eastern States, and they will give their hearty co-operation in effecting this object.⁶⁴

By about mid-decade, the northern counties comprehended that the immediate threat was slavery and not the free Negro. Chase was vindicated and his fear of the slave power carried justifiable weight in the emerging Republican party.

The prospect of slavery in the Lower Midwest made the Civil War inevitable and irrepressible; more important, this threat made the issue of the annihilation of slavery a matter of some urgency.⁶⁵ For every cent that free wages increased, for every farmer

⁶⁰ Quoted in Emma Lou Thornbrough: *The Negro in Indiana: A Study of a Minority* (Indiana Hist. Bur., Indianapolis, 1957), p. 86.

⁶¹ N. Dwight Harris: *The History of Negro Servitude in Illinois and of the Slavery Agitation in that State, 1719-1864* (A. C. McClurg & Co., Chicago, 1904), pp. 188 and 235-236; Cole, *Era of the Civil War* [see footnote 46 above], pp. 224-229; and Thornbrough, *op. cit.* [see footnote 50 above], pp. 58-59.

⁶² "Report of the Debates and Proceedings of the Convention for the Revision of the Constitution of the State of Indiana, 1850" (2 vols.; A. H. Brown, Indianapolis, 1850), Vol. 1, pp. 457-458.

⁶³ Harris, *op. cit.* [see footnote 51 above], pp. 237-238; and Gustave Koerner: *Memoirs of Gustave Koerner, 1809-1896* (edited by Thomas J. McCormack; 2 vols.; Torch Press, Cedar Rapids, Iowa, 1902), Vol. 2, pp. 29-32.

⁶⁴ Cited in Arthur Charles Cole: *Lincoln's "House Divided" Speech: Did It Reflect a Doctrine of Class Struggle?* (Univ. of Chicago Press, Chicago, 1923), pp. 32-33.

⁶⁵ A recent quantitative study of the causes of the Civil War concludes that "northern preferences to eliminate slavery were more than twenty times as strong as those to preserve the Union" (Gerald

who adopted corn as his staple, the potential for slavery became ever stronger. Yankee morality would not hold the line against slavery because, according to one southern critic, their morality was only superficial: "once persuaded to consider this question [of slave labor] . . . it is not apprehended that moral qualms will hinder their action. It requires the least rudimental knowledge of Yankee nature, and no argument at all to show, that where a real interest, and a question of abstract morality conflict in a Yankee's mind, abstract morality will sustain a grievous overthrow."⁶⁶ This jaundiced southerner understood well the moral fragility of the North, but he seriously misunderstood that the real interest of the Lower Midwest departed sharply from its northern margins. In the latter areas slavery remained an alien and inefficient labor system that contributed nothing to society except the problem of the free Negro. These northern counties became bastions of free labor, free soil, and antislavery in the late 1850's.⁶⁷ Excluding slavery from the territories or confining it to the South did not go far enough. They had to destroy it forever so it would not tempt the "real interest" of corn-growing midwesterners. Such was the unequivocal course of action laid out by Abraham Lincoln on June 16, 1858:

In my opinion, it [slavery agitation] *will* not cease, until a *crisis* shall have been reached, and passed. A house divided against itself cannot stand. I believe this government cannot endure, permanently *half* slave and *half* free. I do not expect the Union to be dissolved—I do not expect the house to *fall*—but I do expect it will cease to be divided. It will become *all* one thing or *all* the other. Either the opponents of slavery, will arrest the further spread of it, and place it where the public mind shall rest in the belief that it is in course of ultimate extinction; or its *advocates* will push it forward, till it shall become alike lawful in *all* the States, old as well as *new*—*North* as well as *South*.⁶⁸

Corn culture, rising wages, and incipient slavery in the Lower Midwest had brought the nation to its greatest impasse.

I have tried to show that moral fiber cannot explain the geography of slavery and free labor and that, conversely, the economics of staple crops and labor costs can. Before 1860, slavery was not good or bad, it was merely efficient or inefficient—and labor decisions were made accordingly. We can no more extol the principles of slave emancipators on Maryland's eastern shore nor the Republicans of the northern Midwest who brought the issue of slavery to war than we can denigrate as unprincipled the proslavery advocates in the midwestern corn belt. They all subscribed to and acted on the same set of economic principles. The thesis that moral superiority motivated antislavery northerners must be shown for what it is: a comfortable liberal myth which obviates examination of the basic amorality of the antebellum American economic system.

Gunderson: The Origin of the American Civil War, *Journ. Econ. Hist.*, Vol. 34, 1974, pp. 915-950). This finding is consonant with the argument presented here: if the North had allowed the South to secede peacefully or had they compromised on the issue of slavery in order to preserve the Union, slavery would have persisted and would shortly have expanded into the Lower Midwest. The extermination of slavery, either peacefully or forcefully, was the only course open to the Upper Midwest and the Republican party.

⁶⁶ This essay carries the ominous title, "African Slavery Adapted to the North and North-west," *DeBow's Review*, Vol. 25, 1858, pp. 378-395.

⁶⁷ Cole, *Era of the Civil War* [see footnote 46 above], pp. 101-201.

⁶⁸ Abraham Lincoln: The Collected Works of Abraham Lincoln, 1848-1858 (edited by Roy P. Basler; 8 vols.; Rutgers Univ. Press, New Brunswick, N.J., 1953), Vol. 2, pp. 461-462.

NO-TILL FARMING: THE REGIONAL APPLICABILITY OF A REVOLUTIONARY AGRICULTURAL TECHNOLOGY*

PHILIP J. GERSMEHL

MORE than half of the corn in some parts of the United States emerges from essentially undisturbed soil. Plows, disks, harrows, cultivators, giant tractors, and the other heavy weapons of conventional mechanized farming are absent or lie idle, while slot planters and spray rigs assume the full burden of land preparation and weed control.¹ The system is most commonly known as no-till farming, although it masquerades beneath a multitude of names and subtle regional variations. Proponents predict a rapid spread of the new technology; they project a tenfold increase in no-till acreage within thirty years.² In this paper I shall examine their prediction in the light of the history, characteristics, and geographical limitations of no-till agriculture. Confusion among a variety of crops and production systems will be minimized by restricting the scope of this report to an analysis of slot-planted corn, the most radical and probably the most popular no-till practice.

THE NO-TILL REVOLUTION

The idea that agriculture demands a complete inversion of the surface layer of soil is as much an article of faith as a scientific conclusion. The substitution of chemicals for plows in farming thus exhibits many of the traits of a paradigm shift described by Thomas S. Kuhn.³ According to Kuhn's model, a revolution occurs partly because increasingly intensive use of an existing model begins to produce a growing number of inconsistencies or undesirable side effects. For example, the science of weed pulling may develop as a radical alternative to searching and gathering. Ecological understanding takes a quantum jump when some brave soul stops asking how to identify the habitats where desirable plants grow and begins to ask how to make desirable plants more numerous. The revolutionary question, however, has its roots in the previous thought-world: increasingly intensive food gathering exerts a selective pressure on desirable plants and thus increases the proportion of undesirable species in

* I owe a word of sincere appreciation to John Fraser Hart for his incisive critique of an early draft of this paper; to Carol Gersmehl, who hand planted the first three experimental plots of no-till corn on our farm in western Wisconsin; to almost a hundred Soil Conservation Service officials, agricultural extension agents, and university people who responded to a mailed request for information about the adoption of and problems with no-till practices in their regions; and to the Buelows, the Herbisons, the Johnsons, the Kammraths, the Stichs, and the other farmers who willingly shared their time and expertise.

¹ Slot planting is done with a special planter equipped with a device (angled disk, fluted coulter, miniature rototiller, or narrow chisel) that loosens and prepares a narrow strip of soil, usually only a few centimeters wide, just in front of the seed-planting equipment. The land between the slots is left undisturbed, covered with sod or the residues of a previous crop. Fertilizer is usually spread on the surface of the soil. Insecticide may be incorporated into the slot at the time of planting, whereas herbicide is applied before, during, or after planting, depending on the specific weed problems on the field.

² "Minimum Tillage: A Preliminary Technology Assessment" (prepared for the Committee on Agriculture and Forestry of the U.S. Senate by the Office of Planning and Evaluation, Dept. of Agriculture, Washington, D.C., Sept. 25, 1975), p. 71.

³ Thomas S. Kuhn: *The Structure of Scientific Revolutions* (2nd edit.; Univ. of Chicago Press, Chicago, 1970).

natural stands of plants. Because a revolution must be interpreted partly as a reaction to the consequences of widespread adoption of previous models, some of the characteristics of the revolution can be predicted on the basis of careful observation of the undesirable side effects of "conventional" practices.

The no-till revolution might have occurred in the 1920's or 1930's. Erosion of plowed fields was apparent then to even the casual observer, and one of the outstanding traits of a no-till field is its resistance to erosion. The shape of a revolution, however, is not narrowly determined by the conditions that give it birth. No-till was delayed because there was no effective technology for weed control on unplowed fields, and the advent of fossil-fueled tractors temporarily staved off the need for a radical change in the use of soil. The new mechanical horses did not need to be fed from the land, and the decline in demand for feed allowed millions of acres of erosion-prone land to revert to grass or trees. Meanwhile, terracing and contour farming became less time-consuming and therefore more acceptable to the farmer. Large machines could obliterate small gullies and reshape a damaged field into an apparently uneroded surface. A decade of favorable climate virtually eliminated the dust clouds of the dry thirties. At the same time, textbooks continued to describe erosion in terms of photographs of spectacular gullies (for example, the frequently reproduced pictures of the canyons in Stewart County, Georgia). In the popular mind, erosion was equated with gullying on a grand scale, and the absence of visible gullies in nearby fields lulled people into ignoring the insidious loss of soil by sheetwash and wind erosion.

The general public again became aware of a widespread hazard of erosion in the 1970's. Giant new tractors were not compatible with the intricate system of contours, terraces, and shelterbelts of the previous generation. Fencerows, pastures, and woodlands were plowed as expanding markets exerted pressures to increase the amount of land in production. Soil structure deteriorated as shorter crop rotations and monovalent fertilizers took their toll. A series of dry years brought visible clouds of dust that reminded people of the thirties.

While the nation was becoming aware of the need for a change, postwar research in chemistry gave farmers a powerful new tool, in the form of metabolic pesticides. Older pesticides such as arsenic or copper worked because they were so alien to the chemistry of life that they overwhelmed it and thus destroyed it. Modern metabolic compounds mimic natural regulatory processes: they render a living machine inactive by tampering with its control valves rather than by bludgeoning it into shapelessness. This difference in mechanism enables a modern herbicide to discriminate between crop and weed and makes it much more efficient than older materials in terms of effect per gram of material applied. The reemergence of a need for a change in tillage practices thus coincided with the development of a tool that could eliminate tillage entirely, and an agricultural revolution was under way.

The history of early experimentation with the radical technology of chemical tillage has been well chronicled elsewhere; a capsule summary here seems sufficient.⁴ Tentative efforts in 1952 in New Jersey and Michigan were followed within a decade by resounding successes in Virginia, Ohio, Kentucky, and New York. By 1970, almost every state boasted experiments with drastically reduced tillage. Popular farm maga-

⁴ G. M. Shear: The Development of the No-Tillage Concept in the United States, *Outlook on Agriculture*, Vol. 5, 1968, pp. 247-251.

zines carried articles about the exciting new developments, and farmers began to adopt no-till systems. From a few hundred acres in the mid-1960's, no-till corn production expanded to cover nearly 5 million acres in 1977.⁸

CONSEQUENCES OF A SHIFT FROM CONVENTIONAL TO NO-TILL FARMING

Five million acres provide a sizable outdoor laboratory where the effects of a revolutionary agricultural system can be evaluated. Nevertheless, it is difficult to generalize about the advantages, drawbacks, and side effects of no-till farming because of the multitude of systems that bear the name and because of the wide variety of environments in which they are practiced. All no-till systems are based on the premise that a reduction in the intensity and frequency of soil manipulations would be beneficial. The adoption of no-till farming is not just a substitution of one planter for another. It is a radical change in the use of the soil, and any radical change in a system as complex as agriculture has many ramifications. Proponents of the new techniques usually give long lists of advantages that actually boil down to a few clusters of mutually reinforcing changes. The following paragraphs are unabashedly sweeping generalizations, with many exceptions to every rule, but to qualify each statement here would be more obstructive than constructive. Each paragraph outlines a cluster of related effects that derive from a major change.⁹

No-till farming interposes a barrier of dead organic material between the soil and the atmosphere. Raindrop impact is absorbed by the dead sod or the residues of previous crops. Wind is likewise blunted and unable to dislodge soil particles. Special planters are needed to penetrate the residues.

No-till farming alters the energy budget of the soil, principally by raising the albedo of the surface. Soil temperature goes down in response to the decrease in absorbed energy. Evaporation of soil moisture is retarded and turbulent transfer of heat to the atmosphere decreases. The decline in soil temperature has four agronomic consequences: organic residues in the soil decay slowly, pesticides are not deactivated rapidly, germination of seeds is delayed, and root growth may be inhibited. Crop damage by soil organisms, especially seed borers and rootworms, may become more severe.

No-till farming alters the water budget of the soil surface. The structure of the soil is improved, with less tendency to form a crust. Water can infiltrate more rapidly and the soil becomes more moist. Root growth is enhanced, except on already wet sites. The increase in infiltration leads to a reduction in overland runoff, accompanied by declines in soil erosion, fertilizer loss, and the rate of sedimentation and eutrophication downstream. Pesticides also stay on the land and therefore can be applied in smaller quantities. More land can be used in crop production because row crops become practical on steeper slopes.

No-till farming does not invert the soil. Natural infiltration channels through the

⁸ Frank Lessiter: No-Till Still Moving Ahead, *No-Till Farmer*, Vol. 6, 1977, p. 4.

⁹ Of the hundreds of articles that have been written about no-till agriculture, the following are of special value: Lloyd L. Harröld, G. B. Triplett, Jr., and W. M. Edwards: No-Tillage Corn: Characteristics of the System, *Agric. Engineering*, Vol. 51, 1970, pp. 128-131; S. H. Phillips and H. M. Young: No-Tillage Farming (Reiman Associates, Milwaukee, Wisc., 1973); William R. Oschwald, W. W. Moschler, Donald L. Myhre, and D. M. Van Doren, Jr.: No-Tillage Planting Round Table, *Crops and Soils*, Vol. 22, No. 3, 1969, pp. 14-19; Norman Rask, G. B. Triplett, Jr., and D. M. Van Doren, Jr.: A Cost Analysis of No-Tillage Corn, *Ohio Report*, Vol. 52, 1967, pp. 14-15; "National Conference on No Tillage Crop Production" (Lexington, Ky., 1970); and "Proceedings, No-Tillage Systems Symposium" (Columbus, Ohio, 1972).

profile are not disrupted. Fertilizer accumulates on top of the soil and roots concentrate near the surface. Fields may need to be limed more frequently to counteract fertilizer acidity. Herbicides that must be incorporated into the soil by disking or plowing are no longer usable. Surface weeds are not buried, but neither are old seeds exhumed annually. Crop residues accumulate on the surface, and harmful insects and diseases may overwinter in the trash and become hazardous to future crops.

No-till farming requires fewer trips across a field. Less labor is needed for fieldwork, so field operations can be more timely. Less fuel is used, less horsepower is needed, and less capital is tied up in machinery. Existing machinery can be used on more acres, perhaps by double-cropping or field expansion. The soil does not suffer as much compaction by tractor wheels or tillage implements, so it has less tendency to form a hardpan, but the surface may become rougher and specialized machinery may be needed because conventional planters and harvesters cannot cope with the uneven ground.

No-till farming involves several economic trade-offs. Labor time decreases but management complexity increases. Reductions in machinery and fuel costs are offset by higher pesticide expenses. Yields are often equal to those from conventionally plowed fields and in some cases are significantly higher, but the potential for spectacular crop failure is also greater, because a reduction in the number of field operations also restricts the opportunity to correct errors.

Experiments and demonstrations of no-till farming have been conducted in almost every part of the United States and in many other countries. The various consequences listed above have differing degrees of significance in different environments. The profitability of the system is therefore a dependent variable in a complex system of causes and effects, each with an impact on benefits or costs. When the benefits and costs are weighed by individual farmers, the new technology has been judged advantageous and widely adopted only in a fairly small part of the United States.

PRESENT AND PROJECTED USE OF NO-TILL TECHNIQUES

No-till cornfields are concentrated in a narrow latitudinal band from Maryland to western Kentucky; they taper off in all directions from the central core (Fig. 1). The restricted area of farmer acceptance makes the innovation an intriguing subject for geographical inquiry, the results of which have significance beyond the academic world. A number of legislative bodies and regulatory agencies are looking at no-till farming as a possible solution to some of the more vexing problems of expanding crop production, soil erosion, water pollution, and energy use.⁷

The most vocal proponents of no-till farming are individuals who have had years of firsthand experience with the technology in Virginia, Kentucky, and Ohio. They have

⁷ L. L. Harrold and W. M. Edwards: A Severe Rainstorm Test of No-Till Corn, *Journ. Soil and Water Conservation*, Vol. 27, 1972, p. 30; B. L. Schmidt, M. E. Kroetz, and G. B. Triplett, Jr.: Wind Erodibility of Sandy Soils as Influenced by No-Tillage Systems, *Agronomy Abstracts*, 1968, p. 128; G. B. Triplett, Jr., D. M. Van Doren, Jr., and B. L. Schmidt: Effect of Corn (*Zea mays* L.) Stover Mulch on No-Tillage Corn Yield and Water Infiltration, *Agronomy Journ.*, Vol. 60, 1968, pp. 236-239; William M. Edwards: Agricultural Chemical Pollution as Affected by Reduced Tillage Systems, in *Proceedings. No-Tillage Systems Symposium* [see footnote 6 above], pp. 30-40; B. A. Stewart, D. A. Woolhiser, and others: Control of Water Pollution from Cropland (H-5-1; Dept. of Agriculture, Agric. Research Service, Washington, D.C., 1975), Vol. 1; and, perhaps most important, Minimum Tillage [see footnote 2 above].

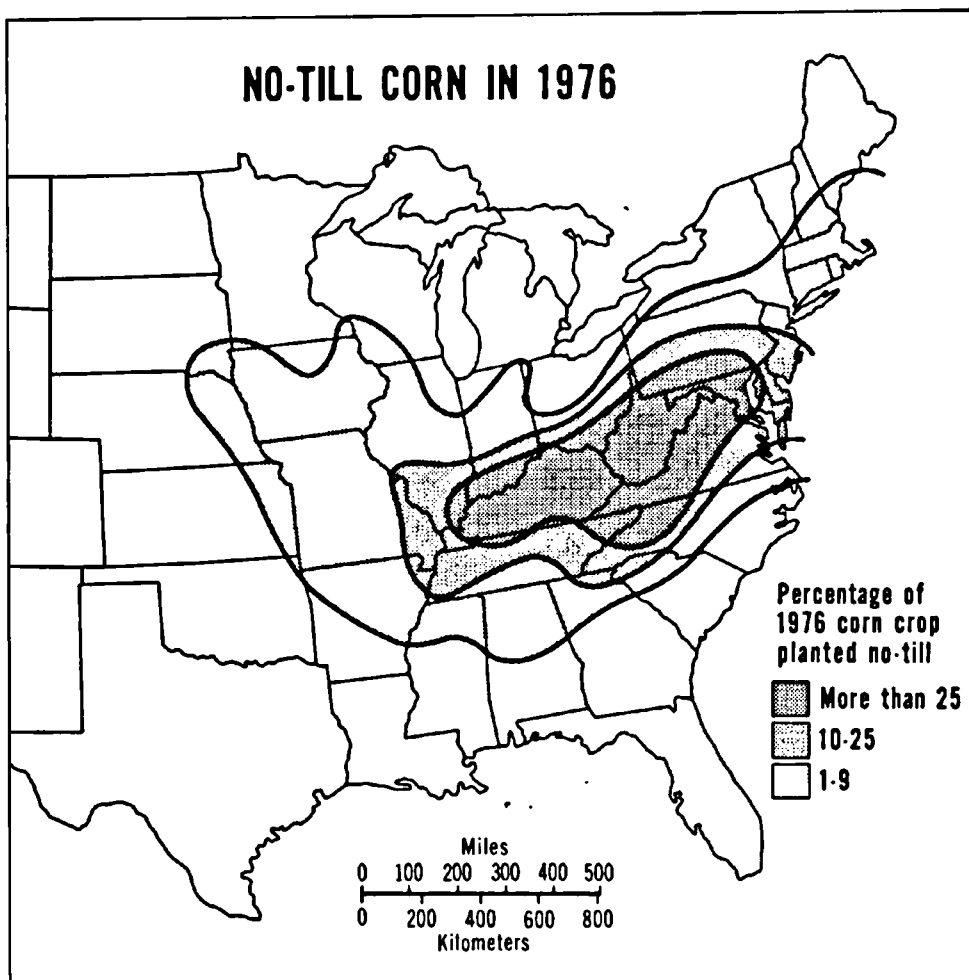


FIG. 1—Pattern of farmer adoption of no-till techniques in corn production. Sources: Estimates drawn from the published literature, state Department of Agriculture surveys, the table of estimates in Lessiter, *op. cit.* [see text footnote 5], and my 1976 poll of state agricultural extension agents and Soil Conservation Service officials.

made a mathematical extrapolation of the historical rate of adoption of no-till practices in their part of the nation, and the result is a graph of projected use of no-till techniques in the United States by the year 2000 (Fig. 2). This forecast has appeared in many scientific, popular, commercial, and governmental publications, and by virtue of its wide dissemination it has great potential influence on agricultural decision making at all levels from the family farm through the federal government.

Unfortunately, the authoritative facade of the tillage forecast graph masks an exceedingly shaky empirical foundation. In the first place, the forecasters assumed that the total demand for crops and the supply of cropland would not be significantly altered by the choice of tillage method. These assumptions allowed them to use existing projections of supply and demand, a valuable and reasonably defensible procedure and one to which I have no major objection. A geographer, however, is considerably less willing to accept their other assumptions: an upper limit of 80

PROJECTED USE OF THREE TILLAGE SYSTEMS

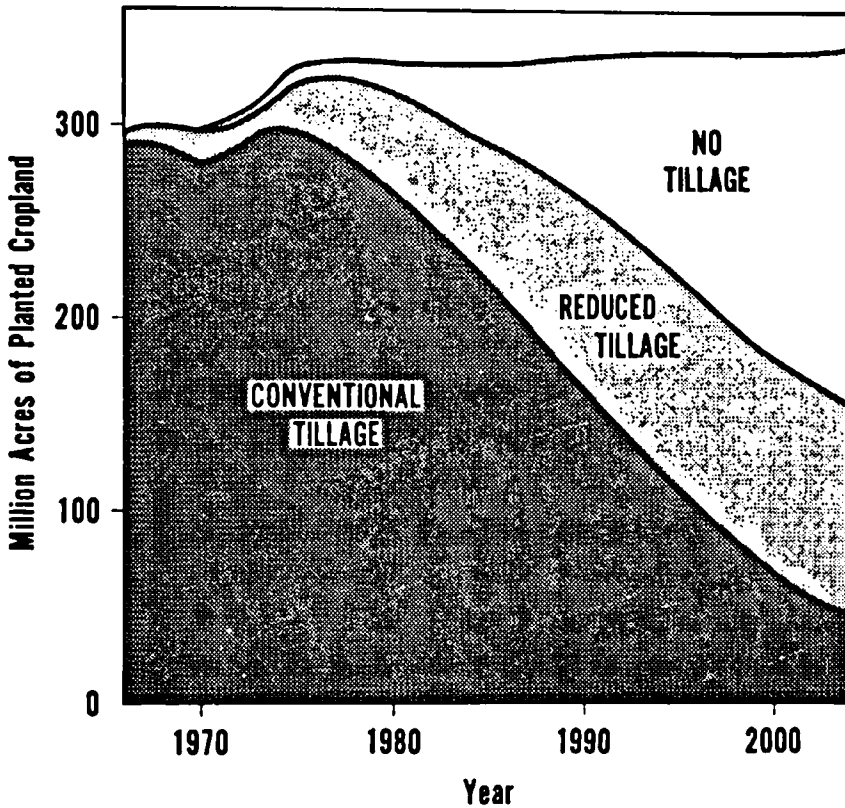


FIG. 2—Predicted use of no-till and minimum tillage techniques in the United States. Adapted from "Minimum Tillage" [see text footnote 2], p. 71.

percent for the adoption of this technology; a future adoption trend that can be determined by fitting a standard sigmoid growth curve to the adoption data for the period from 1963 through 1974; and a rate of adoption that is everywhere "the same, allowing for the fact that some regions are more advanced than others with respect to their position on the adoption curve . . . and the proportion of cropland devoted to the 7 selected crops varies from region to region."⁸

These assumptions are questionable because the present use of no-till techniques may reflect more than mere historical priority. Farmers in other regions may not be simply laggard; they may have sound reasons for refusing to adopt the new method of farming. It is important to ask why some farmers resist the innovation, because a valid interpretation of the present geographical pattern of adoption is the only adequate foundation for a prediction of the spread of the technology.

⁸ Minimum Tillage [see footnote 2 above], pp. 68-71.

RESISTANCE TO NO-TILL FARMING

The geographical pattern of adoption of no-till techniques is associated with six kinds of farmer resistance to the new technology. Three of these barriers are consequences of broad climatic gradients, and the degree of resistance increases with distance from the present center of adoption. Two of the factors of resistance are psychological traits related to a desire for neatness and an unwillingness to take risks. These psychological traits have a cultural and therefore regional association. Finally, the economic problems of labor inefficiency owing to constraints of farm size is a significant barrier to further adoption in the Corn Belt. The combined effects of these six factors limit the spread of no-till farming and suggest the kinds of adaptations that must be made before the new technology can become viable in other areas.

A POLEWARD GRADIENT OF SOIL TEMPERATURE

Many of the benefits of no-till farming occur because the residues of previous crops are left on the surface to absorb raindrop impact and wind energy and thus to lessen soil erosion. Surface residues, however, become a liability where their cooling effect shortens an already brief growing season. The effect of surface residues on soil temperature is beneficial in Texas, negligible in Missouri, detrimental in Iowa, and perhaps lethal for crops in North Dakota.⁹ The problem is compounded on poorly drained fields, northward-facing slopes, heavy clay soils, and other sites that normally remain cooler than their surroundings. For example, most trials of no-till farming on the glacial lake plains of northern Ohio and Indiana have been economic failures; no-till yields on the poorly drained clay are often 20 to 40 percent below those of conventional plow farming.¹⁰ The ultimate cause of the low yield is delayed germination and slow early growth, although the obvious symptoms may include bird depredations, a bad case of rootworm infection, and an inability of the crop to compete with weeds that ordinarily give little trouble.

Two other consequences of low soil temperature intensify the adverse effect on yields. First, organic material decomposes slowly in a cool soil. Consequently, the surface residues persist longer in cool places than in warm ones and may accumulate over several growing seasons.¹¹ Second, low temperature hinders the breakdown of many herbicides. Herbicide carryover poses a significant threat because the residual chemicals from one year may damage subsequent crops in cool soil.¹² An attempt to minimize carryover by reducing the rate of herbicide application runs the risk of incomplete weedkill. Using a plow or disk to mix organic matter or herbicide residues in soil, however, is an efficient way to hasten their decomposition.

A persistent mulch thus becomes a source of difficulty for a farmer in a cool region.

⁹ D. M. Van Doren, Jr.: Changes in Seed Environment Due to Tillage, in *Conference Proceedings: Tillage for Greater Crop Production* (Amer. Soc. of Agric. Engineers, St. Joseph, Mich., 1967), pp. 3-9; and Oschwald and others, *op. cit.* [see footnote 6 above], pp. 14-19.

¹⁰ D. R. Griffith, J. V. Mannering, H. M. Galloway, S. D. Parsons, and C. B. Richey: Soil Temperature, Percent Stand, Plant Growth and Yield of Corn on Five Indiana Soils, *Agronomy Journ.*, Vol. 65, 1973, pp. 321-326; and G. B. Triplett, Jr., D. M. Van Doren, Jr., and Samuel W. Bone: An Evaluation of Ohio Soils in Relation to No-Tillage Corn Production, *Research Bull. 1068*, Ohio Agric. Experiment Stn., Wooster, Ohio, 1973.

¹¹ G. W. Randall, W. E. Lueschen, and J. B. Swan: Effect of Eleven Tillage Systems on Soil Properties and Continuous Corn Grown in Southern Minnesota, *Agronomy Abstracts*, 1973, p. 129.

¹² Philip Kearney: Filling the Gaps in Herbicide Knowledge, *Agric. Chemicals*, Vol. 24, No. 4, 1969, pp. 25-28.

Meanwhile, the problems of erosion, drought, and high soil temperatures are not severe on a poorly drained northern soil, so many of the usual benefits of a mulch cover lose their significance. To date, northern farmers have been understandably reluctant to abandon their plows; they have little incentive to change, and the new no-till techniques have serious drawbacks on their cold soils.¹³

A WESTWARD GRADIENT OF MOISTURE UNRELIABILITY

A surface mulch of dead organic residues is a significant barrier to wind erosion and evaporation of soil moisture. Living weeds, however, negate most of the moisture-conserving advantages of a mulch surface. For this reason, farmers on the dry margins of agricultural regions try to kill unwanted plants but leave their remains anchored to the surface of the soil.

No-till farming would seem to have many advantages in such marginal climates, because nothing holds a protective cover of organic residues on the ground better than an attached root system, and a dead but otherwise undisturbed sod is a poor nursery for weed seeds. Rainwater can easily enter a soil covered by dead grass, but losses of water by runoff and evaporation are minimized.

Despite all of its apparent advantages, no-till farming on chemically prepared fields in semiarid regions suffers from two important drawbacks: the risk of incomplete weedkill and therefore insufficient storage of soil moisture, and the risk of herbicide carryover and resulting damage to subsequent crops. Ironically, both hazards are consequences of the same environmental characteristic, the unreliability of precipitation in semiarid regions, because reliable moisture is a prerequisite for most methods of chemical weed control. Some herbicides simply do not work in the absence of rain. Others will not kill a plant if it is drought-stressed and temporarily dormant. Some volatilize in dry soils and are lost before they can do their job. Still others leach out of the soil in wet years. Even when the weather is favorable, the margin between not enough and too much is narrow for many herbicides.¹⁴ Increasing the variability of the weather decreases the margin of safety and eventually makes chemical farming too risky. It is difficult to trust the chemicals when intrinsic weather variability is so great that the recommended amount of a given herbicide for a dry year is greater than the crop-toxic level for an equally probable wet year. Consequently, most farmers in semiarid regions still use rodweeder, cultivators, sweeps, disks, or other mechanical tools as their primary weapons against weeds.¹⁵ Erosion hazards and projected energy shortages have spurred the search for techniques that achieve the goal of weedkill and seedbed preparation with a minimum of soil disturbance. Nevertheless, farming an essentially undisturbed soil in semiarid regions awaits the development of suitable herbicides whose efficiency is not affected by soil moisture. Given the environmental restraints, the challenge is indeed formidable.

¹³ One possible way to solve the problem of cold soils is by reshaping the ground surface so the row zone dries out more quickly than the interior zone (W. G. Lovely: Ridge Planting of Corn, *Proc. 10th Annual Hybrid Corn Industry Research Conference*, Chicago, 1965).

¹⁴ G. M. Shear: Role of Herbicides in No-Tillage Crop Production, *Agric. Chemicals*, Vol. 20, No. 4, 1965, pp. 31-32; and O. C. Burnside: Sorghum's Number One Enemy: Weeds and What To Do About Them, *Crops and Soils*, Vol. 20, No. 2, 1967, pp. 10-11.

¹⁵ One of the more popular "no-till" implements is a special planter equipped with a number of sweeps, bars, and chisels that disrupt weed roots and heap loose soil up in ridges between the crop rows. A subsequent cultivation flattens the ridges, piles the soil around the crops, and thus destroys weed mechanically. The planter is widely used in Nebraska (where it originated) and surrounding states, but because it disturbs virtually all of the soil it is not strictly a "no-till" tool.

AN EQUATORWARD GRADIENT OF WEED EFFICIENCY

Corn, the crop most often grown with no-till techniques, is a potent competitor once it is established. When the crop is given a weed-free head start of about a month, the yield is usually not affected by a later weed infestation. Efficient farmers therefore aim for total weed control for a month rather than partial control for a full season or complete eradication of weeds. In fact, weeds perform a service when they prevent

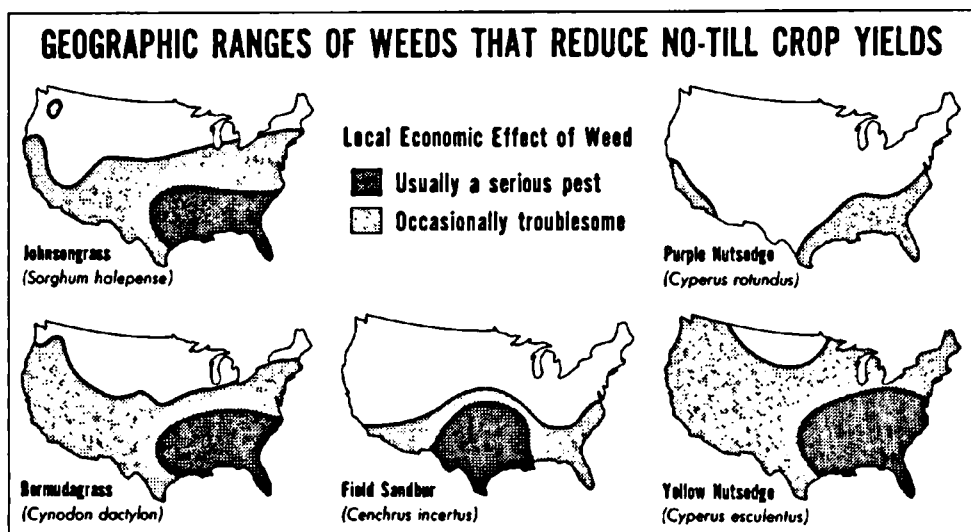


FIG. 3—Distributions of weeds that have been cited by various investigators as major factors in the failures of no-till crops. Adapted from "Selected Weeds of the United States," *Agric. Handbook Number 366*, Govt. Printing Office, Washington, D.C., 1970.

leaching of nutrients and when they protect slopes from erosion during the months when the crop is not on the field.

Scientific weed control is based on exploitation of intrinsic differences in the chemical or physical tolerances of crops and weeds. Weeds that germinate several weeks before planting time are much easier to control than weeds that emerge at the same time as the crop. Plowing is a useful weed-control procedure because it uproots living weeds and buries ungerminated weed seeds so they cannot germinate or emerge in time to compete with crop seeds planted near the surface. Atrazine is an effective herbicide for a cornfield because corn is one of the few plants equipped with the proper enzymes to neutralize atrazine before it causes damage. Phenoxy herbicides affect broad-leaved plants more than grasses and therefore are also useful in corn culture.

No-till farmers are in serious trouble when a weed is so similar to the crop that no chemical weapon can discriminate between crop and weed. By this criterion, the ultimate weed is the "volunteer" crop plant that arises from seed inadvertently missed in a previous harvest. Such a plant usually yields less than its hybrid parents, spews its polyglot pollen over a field, often matures at a different time from the crop, may be a haven for diseases or insects, and usually harbors an unpredictable variety of other genetic throwbacks. Crop rotation is an excellent weapon against volunteerism, because few crop seeds can persist more than a year in the soil. In practice, therefore, volunteer crop plants are usually less dangerous than the plants that are genetically similar to the crop but more persistent in the soil. A striking example of this kind of

weed is Johnson grass (*Sorghum halepense*), a hardy perennial that shares so many cultural and chemical traits with corn and sorghum that no economical herbicide can distinguish the weed. Johnson grass reaches its peak of efficiency on the southern coastal plain, where it routinely destroys no-till experiments.¹⁶ The long growing season in the southeastern states also allows many other weeds to become efficient enough to limit the effectiveness of no-till farming (Fig. 3). The occasional successes of no-till farming in the Southeast usually involve irrigation and large amounts of herbicide on fields that were comparatively free from weeds at the start of the experiments. Even then, failures appear to be more common than successes. One examination of the prospects of combating established Johnson grass or Bermuda grass concluded: "With present herbicides, no-tillage practices cannot be used in these perennial grasses."¹⁷ Present technology can promise partial success against Johnson grass only when the land is treated with a potent combination of herbicides that are disked into plowed soil before the crop is planted.¹⁸ Expansion of no-till agriculture into subtropical regions thus awaits the development of herbicides that are both more effective and more discriminating in their selection of targets.

A PSYCHOLOGICAL BARRIER: PRIDE IN WORKMANSHIP

No-till fields look messy. An irregular or trashy surface is difficult to accept by someone who was raised to view a smoothly pulverized and plant-free seedbed as a reliable way of identifying a good farmer. After a lifetime of trying to avoid the scorn that neighbors gleefully heaped on a "novice plowman," a farmer has difficulty conceiving of intentionally producing a trashy field. "Clean plowing," widely revered among the Teutonic peoples of the Midwest, is a manifestation of a deep-seated "effort ethic" that pervades their economic life.¹⁹ One should hardly be surprised, therefore, to find considerable resistance to no-till farming among the established German and Scandinavian farmers from eastern Pennsylvania to western Minnesota and the Dakotas. Like any subconscious attitude, this kind of resistance is rarely articulated by the farmers themselves.²⁰

ANOTHER PSYCHOLOGICAL BARRIER: RISK PERCEPTION

Psychological resistance to no-till farming also involves an unwillingness to substitute faith for work. A good residual herbicide does not work quickly, and when

¹⁶ J. O. Sanford, D. L. Myhre, and Norman C. Merwine: Double Cropping Systems Involving No-Tillage and Conventional Tillage, *Agronomy Journ.*, Vol. 65, 1973, pp. 978-982; and A. D. Worsham: Herbicide Systems in No-Tillage and Results in the Southeast, in National Conference on No Tillage Crop Production [see footnote 6 above].

¹⁷ J. W. Herron, Lafayette Thompson, Jr., and C. H. Slack: Weed Problems in No-Till Corn, *Proc. 24th Ann. Meeting, Southern Weed Sci. Soc.*, 1971, p. 170; but a partial dissent is made by William E. Adams, James E. Pallas, Jr., and R. N. Dawson: Tillage Methods for Corn-sod Systems in the Southern Piedmont, *Agronomy Journ.*, Vol. 62, 1970, pp. 646-649.

¹⁸ H. R. Hurst, B. L. Arnold, and F. T. Withers, Jr.: Evaluation of Herbicides for Johnsongrass Control in Corn, *Proc. 29th Annual Meeting, Southern Weed Sci. Soc.*, 1976, p. 58; and T. H. Morgan, Jr., John T. Connell, and L. S. Jeffery: Herbicide Systems for Control of Johnsongrass in Corn, *ibid.*, pp. 59-60.

¹⁹ John Fraser Hart: The Middle West, *Annals Assn. of Amer. Geogrs.*, Vol. 62, 1972, pp. 258-282, reference on pp. 271-272; and subsequent personal communication with the author. The rapid adoption of herbicide as a substitute for cultivation in conventional corn culture demonstrates that this effort ethic is not antitechnological; nor is it founded on some concept of the integrity of natural systems. Thus there is no basis for the idea that no-till farming would be widely resisted as a violation of some "organic" ideal. In fact, one could argue that plows and rototillers are as alien to (and disruptive of) the "natural" workings of the soil as some (not all) agricultural chemicals.

²⁰ G. E. Evans: Ask the Fellows Who Cut the Hay (Faber and Faber, Limited, London, 1955), p. 128.

results do not come immediately, nagging doubts worm their way into the farmer's consciousness. The doubts are aided by occasional failures of some herbicides when rain does not come in time to activate them or when too much rain leaches them out of the root zone of the weeds. Conventional plow farmers, faced with an unexpectedly heavy weed infestation, simply schedule another cultivation of the field and are rewarded with the satisfying sight of uprooted weeds shriveling in the sun by midafternoon. No-till farmers, by contrast, usually find that emergency cultivation is not practical. The concentration of crop roots near the surface of unplowed soil increases the likelihood of crop damage, and the trashy surface makes cultivation difficult and inefficient.²¹ Furthermore, cultivation may destroy the residual herbicide barrier in the soil and thus lead to a greater weed infestation. Emergency herbicide applications are possible (and usually effective), but they are costly in terms of money as well as time. Even more important, they are fraught with the same kinds of doubts that plagued the farmer in the first place.

Psychological resistance to no-till farming is reinforced by the cold economic fact of risk trade-offs.²² Crop failure can be a tolerable economic hardship if the investment amounts to no more than fuel, a bushel of last year's crop, and a few days of time. Total risk is low because low financial risk offsets high physical risk of crop failure owing to insects, diseases, weeds, or weather. Insecticides and other safeguards may decrease physical risk, but they increase the financial risk in the event of an unforeseen catastrophe. The treadmill is difficult to stop: each additional expense for crop protection increases the financial investment in the crop and therefore makes the prospect of physical risk even less palatable. The total risk of any given venture may thus be interpreted as the mathematical product of physical and financial risk. The two kinds of risk are interdependent, however, and their mutual influence makes the search for some kind of optimum solution difficult. A modern corn farmer already labors under a heavy burden of financial risk: out-of-pocket costs for fuel, hybrid seed, broadcast fertilizer, lime, herbicide, pesticide, inoculum, pop-up fertilizer, and side dressing may approach \$80 per acre (or \$40,000 for a typical midwestern corn farmer). No-till techniques save labor but they may add as much as \$20 of out-of-pocket costs per acre, or \$10,000 of additional financial risk for the typical farmer. To assume the additional financial risk, to have faith in the effectiveness of a slow-acting herbicide, and to be willing to part with time-tested emergency procedures takes a bold farmer. No-till techniques may ease the labor load, but they greatly increase the burden of management, and many farmers complain that ulcers are already replacing blisters as their chief chronic ailment.

THE ECONOMIC PROBLEM OF LABOR UNDERUTILIZATION

Timesaving devices are worthwhile only if profitable alternative uses of time are available. No-till farming may require fewer hours of fieldwork per acre of corn, but the work load at planting time stays about the same or may even be increased.²³ Moreover, the use of hired help is inefficient, because no-till machinery makes land preparation and crop planting a one-man operation; additional investment in ma-

²¹ Phillips and Young, *op. cit.* [see footnote 6 above], pp. 176-212.

²² "Risk: How to Measure It and How to Manage It" (undated pamphlet issued by the Federal Crop Insurance Corp.).

²³ Wendell Bowers: Scheduling Operations in Minimum Tillage Systems, *Trans. Amer. Soc. of Agric. Engineers*, Vol. 9, 1966, pp. 858-859; and Phillips and Young, *op. cit.* [see footnote 6 above], p. 125.

chinery would be needed in order to employ additional labor profitably. The no-till farmer thus is rushed during planting and usually has a surplus of free time once the critical period of planting is over. The time schedule of no-till farming benefits five groups of farmers: part-time farmers (near urban areas, particularly in the Carolinas and northward), who can schedule other work during slack seasons; "suitcase" farmers (abundant in the Plains states, and becoming more common elsewhere), who operate several farms in different climatic regions; dairy and feedlot farmers (especially in Wisconsin and the urbanized Northeast), who do fieldwork only as a minor sideline to their main enterprise of raising animals;²⁴ double-crop farmers (in Virginia, Kentucky, and southern Illinois, for example), who find that the ability to plant immediately after harvest permits them to obtain two crops a year from land that formerly produced only one;²⁵ and hill farmers (in Virginia, Kentucky, southeastern Ohio, southern Illinois, Missouri, and elsewhere), who have large amounts of sloping land that is too erosive for row cropping by conventional techniques.

The typical midwestern grain farmer does not fall into any of these categories. Most farms in the Corn Belt are simply too small for efficient use of modern machinery and farm labor. Indeed, one of the problems of conventional tillage in the Midwest is that newer and bigger machinery often does little more than induce a farmer with a work ethic to make more trips across the same field.²⁶ Unless fields are enlarged as machines are made bigger, new machinery can lead to overtillage and subsequent erosion. No-till farming saves labor, a surplus commodity, at the expense of cash or credit, a tight commodity. Small wonder that an expansion-minded midwestern farmer is not likely to view no-till techniques with favor. The labor-saving advantages of the new technology look good only to farmers who are already blessed with enough land for efficient use of their machinery.²⁷

THE FUTURE OF NO-TILL FARMING

No-till farming will probably continue to expand in importance in the United States, although I believe that Figure 4 is a better forecast of the trend than Figure 2. The originators of Figure 2 based their forecasts of rapid adoption on the assumption that the successes of the system in the environmentally favorable hill lands of Virginia, Kentucky, and Ohio could be duplicated on the cold northern lake plains, the unreliably watered western grasslands, and the weed-choked fields of the Deep South. These environmental problems may eventually succumb to the ingenuity of agricultural researchers, and the psychological resistance of farmers who prefer clean seed-beds and minimum risk might also crumble in the face of a demonstrably profitable system. The economic problem of inadequate farm size and labor underutilization, however, is a formidable barrier to the widespread adoption of no-till farming.

The actual adoption history reinforces the thesis that no-till farming is viable in only a small part of the country. The developers of the forecast in Figure 2 assumed an

²⁴ John R. Nyé, Jr.: Farmer Acceptance of No-Till Corn in New England, in *Proceedings, Northeastern No-Tillage Conference* (Albany, N.Y., 1970), pp. 33-38.

²⁵ G. E. McKibben: Where Are We in Double-Cropping in Zero-Till, *Proc. 25th North Central Weed Control Conference*, 1970, pp. 25-26.

²⁶ Wendell Bowers and H. P. Bateman: Research Studies of Minimum Tillage, *Trans. Amer. Soc. of Agric. Engineers*, Vol. 3, No. 2, 1960, pp. 1-3.

²⁷ A significant exception to this statement is the farmer who uses a no-till planter as an emergency tool in the event of flood, frost, insect attack, or other catastrophic damage to the first planting of a crop.

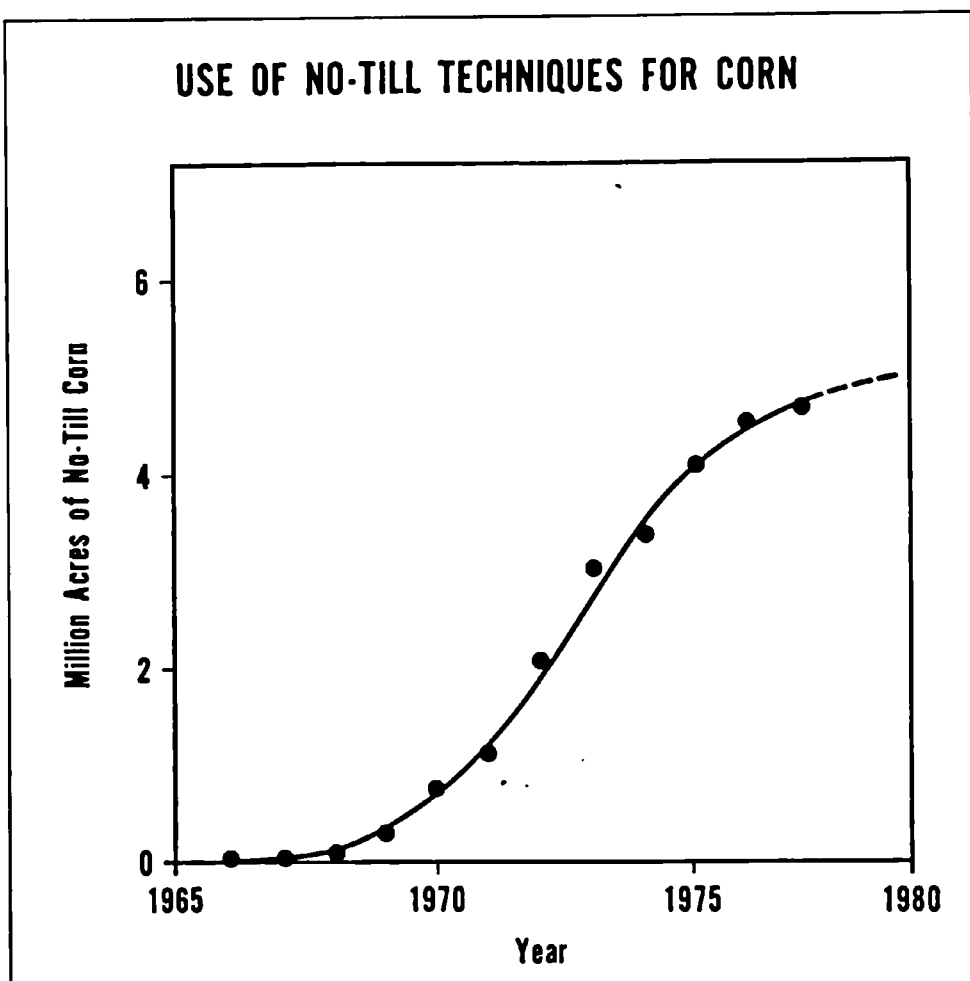


FIG. 4—Trend of no-till corn production in the United States. Sources: Estimates drawn from the literature for the period before 1970 and from Lessiter (*op. cit.* [see text footnote 5]) for 1972–1977.

80 percent upper limit of adoptions, but their curve simply does not fit the data of the past few years. If the procedure is altered so that a standard sigmoid growth curve is fitted to the historical data without an a priori assumption of a particular upper limit, the curve has already passed its inflection point and appears to be asymptotic toward a maximum adoption of no-till practices on less than 10 percent of the total corn crop (Fig. 4). Thus, given present technology, market conditions, and regulations, the no-till revolution is a thing of the past, not a wave of the future.

The rising real cost of energy, however, may prove to be a major economic incentive for a reduction in the number and intensity of field operations.²⁸ A legal

²⁸ Dale O. Hull: Energy Consumption for Several Corn Production Methods (A. E. 1083, Iowa State Univ., Cooperative Extension Service, Ames, 1974); and Howard Wittmus, Larry Olson, and Delbert Lane: Energy Requirements for Conventional versus Minimum Tillage, *Journ. Soil and Water Conservation*, Vol. 30, 1975, pp. 72–75; but see also a dissent by Robert W. Bocke: How Agriculture Uses Energy, *Implement and Tractor*, March 31, 1974, pp. 2–3.

thrust toward tillage reduction may also come if a national soil conservation law is passed or when states begin to enforce the sediment-yield laws that are already on the books in many parts of the country.²⁹ These laws, however, should be phrased and enforced in a manner that recognizes regional differences in the applicability of various tillage techniques; otherwise, the resulting economic inequities may provoke considerable political backlash.

The substantive point of this paper is that a national agricultural policy should not be based on the unfounded assumptions that underlie the currently fashionable forecast of future American tillage practices. The investigation of the regional applicability of no-till techniques also raises a critical political question, Is the public adequately served by a procedure for formal technology assessment with no mandatory safeguards against error arising from the parochial outlook of a small number of consultants?

²⁹ Kenneth J. Nicol, Howard C. Madsen, and Earl O. Heady: The Impact of a National Soil Conservancy Law, *Journ. Soil and Water Conservation*, Vol. 29, 1974, pp. 204-210.

APPLIED GEOGRAPHY

SETTLEMENT SITES ALONG THE NORTHWEST PASSAGE*

ROY J. FLETCHER[†]

AS PEOPLE become interested in the Arctic for military, meteorological, mineral resource, and other reasons they quickly discover that little has been published about areas which are relatively hospitable for permanent or semipermanent settlements. The 1969 voyage of the tanker *Manhattan* through the deepwater northern route of the Northwest Passage sparked renewed interest in ocean travel in Arctic Canada (Fig. 1). Most occupied settlements, however, lie on either side of the navigable but shallow water passage between the western islands and the mainland of Canada. Along this southern route of the Northwest Passage and elsewhere in the Arctic settlements will be created and the character of presently populated places will be altered, in part as a result of the relative advantages of their sites.

Until the mid-1950's selection of a settlement site was carried out by water. Sites with good anchorages for explorers' vessels during the last century were usually investigated by modern icebreakers because the bathymetry was already charted and safe passage was therefore insured. In 1946 and 1947 icebreakers searched Parry Channel to locate favorable sites for weather stations in the central Canadian Arctic. Less than a decade later numerous settlement locations from Alaska to Greenland were chosen for the Distant Early Warning (DEW) Line by using aerial photographs and on-the-spot inspection. However, the paramount consideration in selecting DEW Line sites was that the radar facilities had to be approximately fifty miles apart. As a result, many of the sites have severely inadequate anchorages and water approaches and are beset by other problems, mostly having to do with transportation. Indeed, about half of the radar stations have been abandoned because of poor sites and because of advances in radar and communications technology.

PHYSICAL SITE REQUIREMENTS

Although the location of a settlement may have been chosen for cultural reasons, its potential for growth depends largely on its physical geographical attributes. The most important aspects of the physical site are related to conditions of land and water that permit residents to function comfortably and efficiently. Various aspects of engineering geology and transportation geography and their application to the arctic environment are proffered here as a basis for an objective evaluation of specific settlements.

SURFICIAL GEOLOGY FAVORABLE FOR CONSTRUCTION OF BUILDINGS

Fine-grained soils are not favorable for construction in the Arctic because the permanently frozen ground frequently contains wedges and lenses of ice. This ice will melt if the insulating surface layer of vegetation is removed, especially if additional heat is provided by poorly insulated buildings and pipes or a layer of heat-absorbing asphalt. Settling and slumping result.¹ For example, the warmth from buried sewer lines in an Alaskan town caused a

* I wish to acknowledge, with gratitude, the assistance provided by the University of Lethbridge Research Committee and the Department of Geography, and especially by Stanley Young and Jean Irwin.

¹ Among the many fine works that have been published in English since World War II on permafrost and on construction in areas of continuous permafrost are "A Report on a Conference-Workshop, Building

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permanent thaw seven feet deep, and the ground slumped two feet in two years.² Because they signify the presence of permafrost near the surface, of much ground ice, and of fine-grained soils, lowlands with grassy vegetation or pingos, patterned ground (especially small, low-centered ice-wedge polygons), and solifluction stripes should be avoided as construction sites.³

Construction on coarse-grained material, such as gravel or clean sand, is usually acceptable because the ground ice forms in spaces between the grains, excess water is expelled downward, and little heaving results. During the melt period arctic rivers become torrential, and in some areas all overland transportation is halted. Bridges are necessary for such a short time that few are built, although culverts may be installed. Because of their gentle slope, homogeneous soil and good drainage, alluvial fans and braided stream deposits appear to be excellent construction sites but should be avoided if any indications of flooding are observed.

Robert E. Frost found that the best construction sites on permafrost in Alaska were gravel terraces, because of their coarse soil texture, good drainage, and flat profile.⁴ It is important that these terraces be of fluvial or marine origin and not produced by solifluction, which implies a shallow thaw zone and surface instability. Marine terraces and strandlines with coarse-textured soil have proved acceptable for airstrips. Because they are shoreline features, over a distance of several miles the elevation of an individual terrace or strandline should be almost uniform. The terraces represent contours, so any road or airstrip constructed along their length will be level. A slope, usually very gentle, can be expected at right angles to them. Solid rock is more difficult to excavate than frozen soil; but rock, unlike soil, will not lead to problems of freezing or drainage unless it is severely jointed or faulted. However, it is better to leave the permanently frozen soil or rock as it is and lay down an insulating layer of clean gravel several feet thick.

THE AIRSTRIP

Second in priority to adequate housing are transportation facilities, preferably year-round. This requirement is usually met by constructing a short (3,000-to-6,000-foot) gravel airstrip. The amount of level ground that is needed depends on the gross weight and rate of climb of the aircraft using the airstrip and on the direction of the runways (which in turn should be governed by the direction of the prevailing winds and by the strongest winds).⁵ Much of the Arctic is sufficiently flat for the construction of suitable airstrips, but in the polar regions of

in Northern Communities, Held at the Université de Montréal, May 7-11, 1973" (edited by Michael Glover; Arctic Inst. of North America, Montreal, 1974); Kenneth A. Linell and G. H. Johnston: Engineering Design and Construction in Permafrost Regions: A Review, in *Permafrost: North American Contribution, Second International Conference, Yakutsk, 1973* (Natl. Acad. of Sciences, Washington, D.C., 1973), pp. 553-575; Richard L. Berg and George W. Aitken: Some Passive Methods of Controlling Geocryological Conditions in Roadway Construction, in *ibid.*, pp. 581-586; Larry W. Price: The Periglacial Environment, Permafrost, and Man, *Commission on College Geogr. Resource Paper No. 14*, Assn. of Amer. Geogr., Washington, D.C., 1972; "Terrain Evaluation in Arctic and Subarctic Regions," *Tech. Manual TM 5-852-8*, Dept. of the Army, Washington, D.C., 1966; S. Russell Stearns: Permafrost (Permanently Frozen Ground), *Cold Regions Science and Engineering Monograph 1-A2*, United States Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H., 1966; R. F. Legget and H. E. Dickens: Building in Northern Canada, *Tech. Paper No. 62*, Div. of Building Research, Natl. Research Council of Canada, Ottawa, 1959; "Permafrost—A Digest of Current Information," *Tech. Memorandum No. 49*, Associate Committee on Soil and Snow Mechanics, Natl. Research Council of Canada, Ottawa, 1957; and "Arctic Engineering," *Tech. Publ. NAVDOCKS TP-PW-11*, Bur. of Yards and Docks, Dept. of the Navy, Washington, D.C., 1955.

² Robert F. Black: Some Problems in Engineering Geology Caused by Permafrost in the Arctic Coastal Plain, Northern Alaska, *Arctic*, Vol. 10, 1957, pp. 230-240.

³ Stearns, *op. cit.* [see footnote 1 above]; Roy Jackson Fletcher: The Use of Aerial Photographs for Engineering Soil Reconnaissance in Arctic Canada, *Photogrammetric Engineering*, Vol. 30, 1964, pp. 210-219; and Arctic Engineering [see footnote 1 above].

⁴ Robert E. Frost: Evaluation of Soil and Permafrost Conditions in the Territory of Alaska by Means of Aerial Photographs, *Tech. Report TM-34*, Corps of Engineers, Dept. of the Army, St. Paul, Minn., 1950.

⁵ Robert Horonjeff: *The Planning and Design of Airports* (McGraw-Hill, New York, 1962).

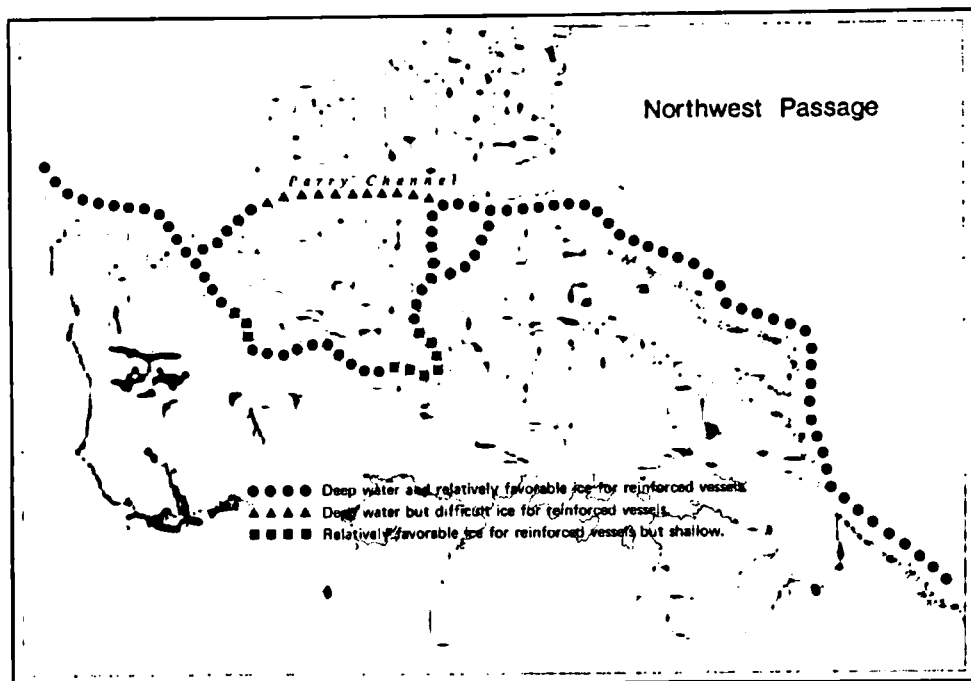


FIG. 1

central and eastern Canada and in almost all of Greenland coastal lowland sites are seldom extensive and are usually surrounded by uplands.

Rugged terrain may mean that the approach zone is shorter or narrower than required by standards of the International Civil Aviation Organization (ICAO).⁶ Because obstructions may be dangerous, especially during instrument landings, elevated sites are preferable, if they are accessible to and near the settlement and the landing beach. However, with every thousand-foot increase above sea level the runway should be lengthened by a thousand feet in order to meet ICAO standards. Most of today's large passenger jet aircraft require a runway of at least 8,000 feet at sea level. For military jets, many of which have high landing speeds, the runway should be at least 10,000 feet long. At small settlements a short gravel runway would be sufficient for STOL (short takeoff and landing) aircraft. But space for a longer runway should be available. Because weather conditions for aircraft in the Arctic are often poor, especially in summer and autumn, airport facilities must be more extensive than elsewhere. This need is met with longer runways, landing lights, hangers, powerful radios, and other aids even at small, little-used airports.

Landforms of little relief, such as marine terraces and large areas of strandlines, having a coarse-textured soil and individual pieces of which are not too angular, large, or soft, should provide an airstrip with a stable runway base, good drainage, and an acceptable asphalt aggregate, if required.

In general all runways and roads in areas of continuous permafrost should be composed of clean gravel and should lie several feet above the surrounding terrain. They may be damaged by heaving and slumping, but repair by grading is not difficult. Dust is often the major problem. Experience in northern coastal Alaska has shown that neither rigid concrete nor steel mats affect permafrost adversely (especially if painted white). Blacktop pavements are powerful heat conductors and absorbers, however, and in summer the active layer may become much thicker than it was before construction.⁷ The pavement may soon become damaged by the

⁶ "International Standards and Recommended Practices, Aerodromes" (3rd edit.; Internatl. Civil Aviation Organization, United Nations, New York, 1958).

⁷ Kenneth A. Linell: Airfields on Permafrost, *Journ. Air Transport Div., Proc. Amer. Soc. of Civil Engineers*,

melting of ground ice, if much ice is present, and by the freezing of water that collects below the surface as a result of the altered subsurface drainage. Experiments at Thule, Greenland, showed that a gravel pad at least eight feet thick was needed underneath asphalt runways to prevent permafrost deterioration.⁸ Asphaltic concrete is more flexible, adjusts to a small amount of settling, and has proved acceptable if the pavement is as thick as conventional concrete.⁹

WATER APPROACHES AND LANDING BEACHES

A sheltered harbor or cove that protects vessels from strong winds and waves is desirable for the safe and rapid unloading of supplies. If the prevailing June-to-September wind is oriented offshore and in the same direction as the harbor it can be expected that the ice will be blown out of the bay early in the warm season. Also, the midsummer drift ice will be less likely to move into the bay. To prevent ice from entering during unloading it is best that the harbor mouth face away from the dominant ocean surface current. If the bay entrance is wide it should not narrow appreciably inland. A narrow entrance, on the other hand, should provide excellent shelter from drifting ice and currents. But in this case the ice is likely to remain long after nearby wide-mouthed inlets are ice-free. Wind, the major factor in removal of bay ice, may be from a favorable direction but the narrow entrance can effectively prevent a rapid exit. This disadvantage may not occur if a relatively large river empties into the bay (such as the Tree River, which enters Port Epworth). In general the most favorable locations along the Northwest Passage lie on the southern and southeastern coasts of islands and peninsulas.

The water must be deep, even close to the shore, to facilitate safe passage and easy lighterage by landing craft or direct unloading at a wharf. For many areas of the Arctic there are few references to depth in the hydrographic literature or on bathymetric charts. However, some harbors that serve settlements, especially those of the DEW Line, are relatively well mapped and marked with various navigational aids.¹⁰

Unlike the foreshore, landing beaches should be gently sloping to allow easy unloading, storage (of gasoline and other bulk supplies), and transport to the settlement site.¹¹ Gravel is most desirable as a beach material and is commonly associated with marine strandlines. Access to the interior must not be obstructed by marshes, lakes, steep slopes, or soils containing much ground ice. The maximum road grade should not exceed 7 or 8 percent for heavy wheeled vehicles, although it may be steeper for short distances where tracked vehicles are used.

ADEQUATE WATER SUPPLY

In general the Arctic is a desert, with most areas receiving less than ten inches of precipitation annually. About a third of this falls as rain during the brief warm season. In May and June the winter snow melts rapidly and flows to the sea or to lakes with inland drainage. After only a few weeks the land is bare, except where there is a summer supply of meltwater from glaciers or snow patches in shaded ravines. Groundwater in the active layer is limited in quantity and of low quality. The occasional rain shower or sleet storm may occur in summer, but most days are dry and, unless a lake is nearby, clean drinking water may not be available. Lakes without outlets, especially if they are small, often contain brackish water. Lakes near the seacoast may be saline.

Today almost all arctic settlements use water from nearby lakes and rivers in both winter and summer. Large above-ground storage tanks have been used, but it is difficult to protect the water from freezing in winter. Occasionally water is trucked or piped to the community and

Vol. 83, 1957, 1326: 1-14; and Angelo Ghiglione: Paving the Permafrost, *Asphalt Inst. Quart.*, Vol. 10, 1958, pp. 4-7.

⁸ "Roads and Airfields," *Tech. Manual TM5-250*, Dept. of the Army, Washington, D.C., 1957, p. 49.

⁹ James D. Lang: Construction and Maintenance of Airfields in the Far North Regions, *Dynamic North*, Dept. of the Navy, Washington, D.C., Vol. 2, 1956, p. 9.

¹⁰ "Pilot of Arctic Canada" (2nd edit.; 3 vols.; Hydrographic Service, Dept. of Mines and Tech. Surveys, Ottawa, 1968).

¹¹ T. A. Harwood: Logistic Problems in the Canadian Arctic, *Polar Record*, Vol. 10, 1961, p. 367.

sold directly to the users. If a pipe is adequately insulated against freezing, water can be pumped through lake or river ice to the surface, thus alleviating the cost and time required to melt snow or ice in winter. Although the lake need not be large, it should be quite deep because ice will probably attain a thickness of seven or eight feet in late winter. It is preferable to have late-winter water depths of at least fifteen to twenty feet in order to insure a relatively high degree of purity.¹²

WASTE DISPOSAL

Adequate disposal of man's waste products is one of the more serious problems of life in the Arctic. Severe pollution is difficult to prevent if the settlement is large and far from the seacoast or a river of considerable flow. Garbage pits are not practical unless a ravine is available because the permanently frozen ground inhibits excavation. Oil exploration camps have used explosives to create small pits. Dumps are often scattered over the open tundra. Trucks can visit them without difficulty in winter, but the tundra may be too wet for easy access in summer. Normal methods of burying humans is also prohibited by permafrost. A shallow trench may be dug and the body covered with a layer of earth, gravel, or small boulders a foot or two thick.

Organisms, some of which may be harmful to man, can remain viable for months in cold water. Therefore sewage treatment in shallow stabilization ponds, though generally successful in the Arctic, is a slow process.¹³ Combustion, especially by incineration, is a costly but practical method of sewage disposal in small settlements such as weather stations. In some Eskimo communities sewage is placed in discarded oil drums during the coldest months, and as long as it remains frozen it is not too offensive to sight or smell.

SEA ICE AND WATER TRANSPORTATION

Sea ice will form most quickly if the air temperature remains below freezing continuously, if there is no wind, and if the water has little vertical mixing, current, salinity, or depth. If too many of these factors are present, a particular bay or strait may stay frozen all year long; if none of these conditions is present fast ice may not form there.

In areas that are protected from high winds, high tides, and strong currents, the thickness of undisturbed ice depends largely on the number of degree-days below freezing. Maximum thickness, usually achieved in early June, averages six or seven feet in most bays in the northern islands of Canada and slightly less in the southern Arctic. If ice floes remain in polar waters for more than one winter they normally gain only about a foot in thickness. But multiyear ice is less saline and harder than the one-year type found in most of the Northwest Passage. Winds, currents, and tides can place great horizontal pressure on the ice and result in cracking, rafting, and hummocking. This pressured ice may be quite thick, impenetrable to most icebreakers, and too rough for over-ice surface transport. Surface sea transportation is impossible in most of the Arctic during the winter for all but a few large and powerful icebreakers. Passage becomes feasible when the winter pack ice breaks up and begins to drift to warmer waters in the summer and autumn.

Many factors influence navigability in drifting ice, a few of which are age, type, size, and, especially, concentration of floes.¹⁴ Because vessels differ in their ability to pass through ice,

¹² A comprehensive survey appears in Amos J. Alter: *Water Supply in Cold Regions*, *Cold Regions Science and Engineering Monograph III-C5a*, United States Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H., 1969.

¹³ Amos J. Alter: *Sewerage and Sewage Disposal in Cold Regions*, *Cold Regions Science and Engineering Monograph III-C5b*, United States Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H., 1969; *idem*, *Water Supply and Waste Disposal Concepts Applicable in Permafrost Regions*, in *Permafrost* [see footnote 1 above], pp. 577-580; and G. Heinke and others: *Some Problems of Solid and Liquid Waste Disposal in the Northern Environment*, *Report 74-10*, Dept. of the Environment, Environmental-Social Committee, Northern Pipelines, Task Force on Northern Oil Development, Ottawa, 1974.

¹⁴ Edwin A. MacDonald: *Polar Operations* (U.S. Naval Inst., Annapolis, Md., 1969); and Edwin A. MacDonald: *Polar Shiphandling* (Arctic Inst. of North America, Washington, D.C., 1965).

some criteria for determining navigability are necessary. Icebreakers and most dry cargo vessels can break a floe if necessary by riding up on it and crushing the ice with their own weight. Sharp-bowed vessels such as tankers must use a ramming technique that requires especially strong engines and superstructures.

Icebreakers can move quickly through pack ice composed of small floes that cover up to 90 percent of the surface, but concentrations of large floes that cover more than 90 percent are considered a barrier. Extensive areas of pressured or multiyear ice are impenetrable except along lines of weakness, where progress is slow and also dangerous. Icebreakers can usually pass with little difficulty through ice that is covered with at least 50 percent puddling (pools of meltwater on the surface of solid, though decaying, ice). If the ice is so thin that it looks dark blue or black from the air it should provide little resistance to an icebreaker.¹⁵

With the construction of the DEW Line stations the number of vessels entering the arctic waters of North America increased greatly. In recent years we have learned a great deal about the most favorable periods for passing safely among the southern islands of arctic Canada, but day-to-day variability of ice conditions remains a handicap to efficient traffic of large cargo vessels without icebreaker assistance. Ocean freighters with reinforced bows and escorted by icebreakers can pass through ice that covers 50 to 70 percent of the surface, depending on the size of floes, their degree of decay, and the number of icebergs. Fortunately, during the navigation season, when ice coverage is usually less than 50 percent, large floes are not common. Even so, an icebreaker should remain nearby so that aid can be provided if necessary. Supertankers such as the *Manhattan* can work heavier ice because they have great power and weight. However, they require considerable strengthening. Although icebergs may be a problem off the east coast of Baffin Island and Labrador, the most difficult ice conditions along the Northwest Passage occur in the western half of Parry Channel.

ICE AND WATER LANDING SITES FOR AIRCRAFT

Because shipment of supplies from southern Canada is most economical by water, the buildings of a settlement site should be near the seacoast. Sea ice may be level enough to provide a temporary winter airstrip, but snow, tidal action, and hummocking often make the surface too rough. The thickness of ice necessary for an aircraft to land depends on water salinity, air temperature during formation, and the weight of the aircraft.¹⁶

Multiyear sea ice, if it is smooth, is more favorable for an airstrip than young sea ice, but freshwater ice of the same thickness is stronger yet. Even large aircraft, except the new jumbo jets, can use airstrips on lake ice (not sea ice) in March or April, when it is seven or eight feet thick. Unfortunately, only a few lakes near the shores of the Northwest Passage are long enough to accommodate the larger aircraft. Also, heavy aircraft parked on lake ice initiate cracking because freshwater ice is brittle.

The ocean or lakes can be used as water landing areas by small, float-equipped aircraft providing there is no interference from ice, waves, or physiographic obstructions.

SITE ASSESSMENT OF OCCUPIED, RECENTLY ABANDONED, AND POTENTIAL SETTLEMENTS

Large-scale aerial photographs of currently occupied and recently abandoned settlements along the Northwest Passage from northern Labrador to the Alaska boundary were assessed on the basis of fourteen aspects of site. Abandoned small trading posts along the route were not evaluated unless they were occupied for a number of years or exhibited relatively good site qualities. These factors are listed in Figures 2, 3, and 4 and in Appendix I in approximate order of importance. My evaluation is based on the condition of the physical environment of the

¹⁵ William J. Kiernan, Jr.: *Modern Triumph in the Northern Ice*, *U.S. Naval Inst. Proc.*, Vol. 83, 1957, pp. 742-752; and "Manual of Ice Seamanship," *Hydrographic Office Publ. No. 551*, Dept. of the Navy, Washington, D.C., 1950.

¹⁶ "Ice Airfields," *Manual AFM 86-5*, Dept. of the Air Force, Washington, D.C., 1958.

settlement, not the man-made structures. Thus the airstrip area is considered, not the actual length of the runway, which may be considerably shorter than could have been constructed. In this assessment, off-loading would be directly on the beach and not at long quays such as at Frobisher Bay.

Most presently occupied settlements are either Eskimo communities or radar stations. Only Resolute (primarily a weather station), Johnson Point and Swimming Point (petroleum exploration depots), and Nunisvik (a lead-zinc mine) have other functions. A few settlements, especially in the case of DEW Line stations, have building sites nearby that are considerably more favorable than those currently occupied. For example, the buildings at Kivitoo and Pearce Point are on top of hills even though large, flat areas near the landing beach and airstrip remain uninhabited. The requirements of radar range dictated a building location there that would be absurd for any other settlement function. In Appendix I the inhabited site evaluation "number" has been placed in parentheses to indicate that sites better than the present location are available nearby.

An existing settlement may be so well located that site considerations are secondary. This is true, again, for the DEW Line stations that initially had to be located approximately fifty miles apart. Excellent fishing and trapping encouraged the initiation and growth of many older settlements, which are deficient in several major aspects of site. River mouth locations such as Coppermine village were favored by Eskimos and fur traders because they afforded relatively easy access to the interior, were sources of freshwater, and were marked by early melting of the sea ice. Yet the earlier site advantage of excellent canoe and sled routes to the interior may not be important today, for transport is by ocean vessel and aircraft. Where fur trapping ceased to be significant, the main reason for the settlement's location may have been lost. Such a settlement may remain small or, if large, possibly it should be moved to a more favorable site.

The abandoned settlements include fourteen DEW Line stations, most of which had extremely poor sites for any function except radar surveillance. Saglek, Cape Warwick, and Brevoort Harbour were DEW communications stations. The remaining weather stations, Royal Canadian Mounted Police posts, and trading posts had attracted a few Eskimo families but were mostly small and exhibited at least one aspect of site that was unacceptable. Most of them had a small, well-protected harbor but no airstrip site. Dundas Harbour and several others were very short of fresh water.

My selection of sites for potential settlements was based on several factors, especially those of superlative harbor and airstrip area. The sedimentary rock region of the western Arctic has numerous excellent airstrip and building sites but few deep, protected harbors. Thus a number of DEW Line stations, such as Komakuk, are resupplied by vessels that must anchor several miles offshore in an open roadstead, where they are susceptible to interference from drifting ice and rough sea. In the eastern Arctic, where the terrain is more rugged (metamorphic and granite rock) deep, large, and well-protected harbors are relatively numerous, but large, flat airstrip areas near the coast are almost nonexistent. Where metamorphic rock has been severely folded or where areas of metamorphic and sedimentary rock are intermixed, both harbor and airstrip requirements may be met. Sites on the northern and western sides of the Northwest Passage were selected because the prevailing west to north winds clear the harbors and open the water approaches. The opposite coasts are blocked by sea ice during much of the navigation season, and in some years a harbor there may never be entirely clear of ice unless a large river enters it.

Initially, I inspected all published topographic maps and hydrographic charts in order to identify potential sites. Other sources, such as the sailing directions or ocean pilots published by Canada, the United States, and Great Britain, yielded additional information.¹⁷ Unpublished, usually government-sponsored, investigations were also helpful.¹⁸ Sites that appeared to

¹⁷ See especially *Pilot of Arctic Canada* [see footnote 10 above].

¹⁸ Many unpublished reports are available in government and private libraries. Of special value are the large "Encyclopedia Arctica" of the Stefansson Collection, Dartmouth College, Hanover, New Hampshire,

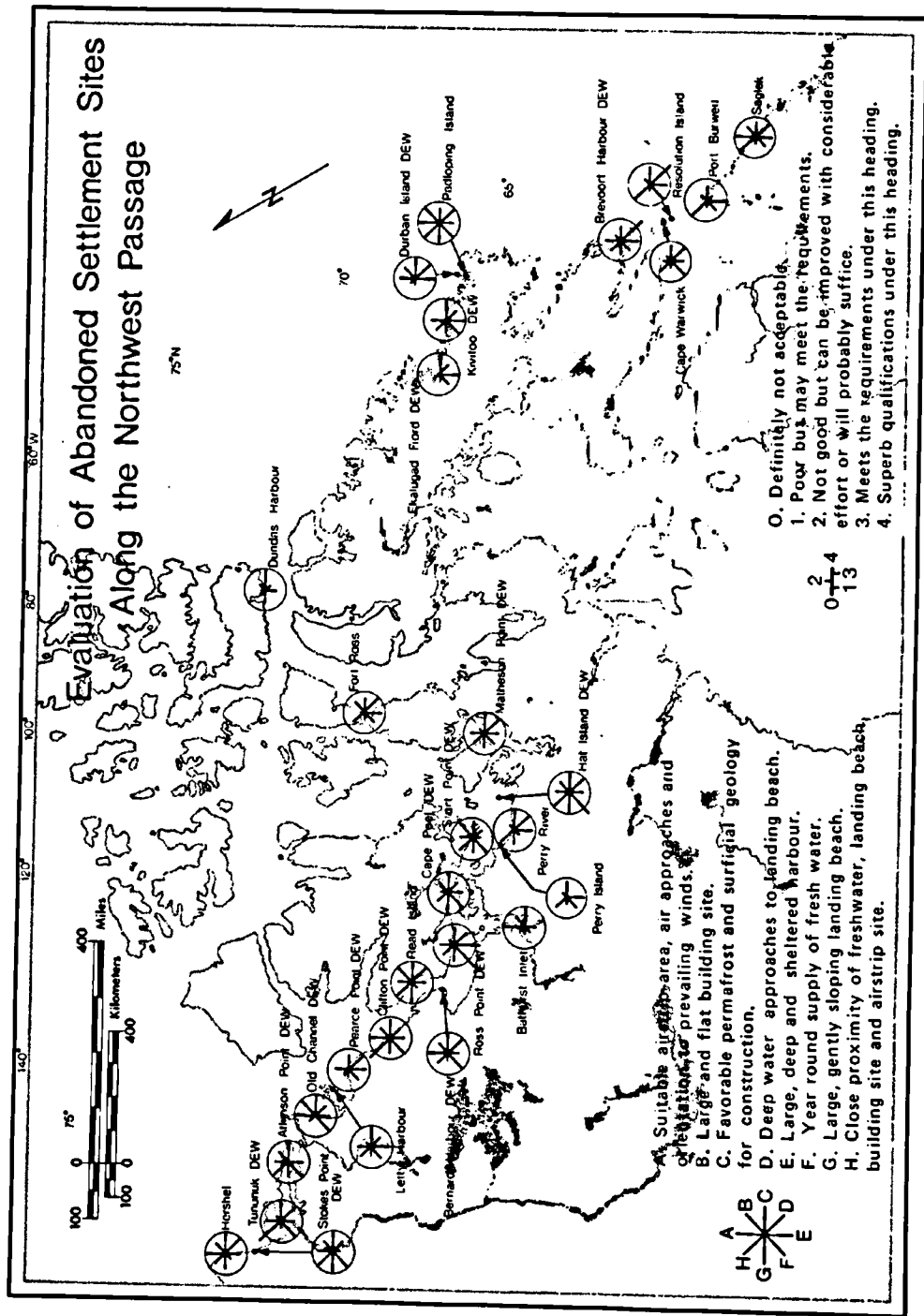


FIG. 3- Evaluation of abandoned settlement sites along the Northwest Passage. A good site should have a graph outline in the shape of a large, nearly perfect circle.

Evaluation of Potential Settlement Sites Along the Northwest Passage

Scale: 0 to 400 Miles / 0 to 400 Kilometers

Compass Rose: 75°N, 70°N, 140°W, 130°W, 120°W, 110°W, 100°W, 90°W, 80°W, 70°W, 60°W, 50°W, 40°W, 30°W, 20°W, 10°W, 0°

Legend:

- A. Suitable air-sea area, air approaches and prevailing winds.
- B. Large and flat building site.
- C. Favorable permafrost and surficial geology for construction.
- D. Deep water approaches to landing beach.
- E. Large, deep and sheltered harbour.
- F. Year round supply of fresh water.
- G. Large, gently sloping landing beach.
- H. Close proximity of freshwater, landing beach, building site and airstrip site.

Map Labels (from top to bottom):

- West Hooker Bay
- Bay E. G.
- James's Cove
- Port Leopold
- East Baring Channel
- Deser's Bay
- North Baring Bay
- Call Bay
- Wild Harbour
- W. Dufferin Bay
- Lady Richardson Bay
- Best Bay
- West-Johnson Bay
- Smith Point Peninsula
- South Salish Ford

Map Symbols:

- 1. Definitely not acceptable
- 2. Poor but may meet the requirements.
- 3. Not good but can be improved with considerable effort or will probably suffice.
- 4. Meets the requirements under this heading.
- 5. Superb qualifications under this heading.

Map Orientation: 75°N, 70°N, 140°W, 130°W, 120°W, 110°W, 100°W, 90°W, 80°W, 70°W, 60°W, 50°W, 40°W, 30°W, 20°W, 10°W, 0°

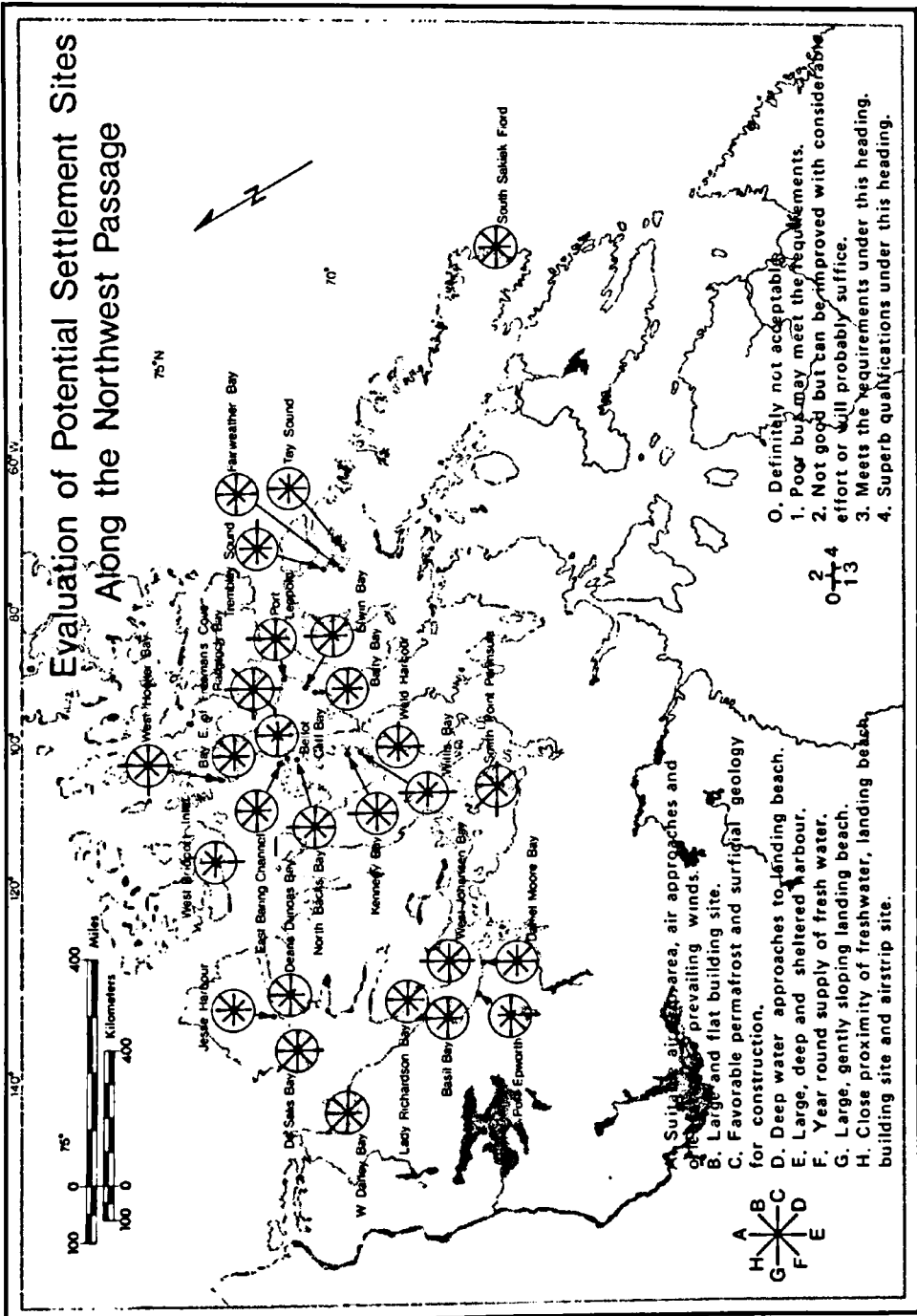


FIG. 4.—Evaluation of potential settlement sites along the Northwest Passage. A good site should have a graph outline in the shape of a large, nearly perfect circle.

be physically desirable were studied further on aerial photographs. A few, in the central Arctic, were investigated in the field.

Figures 2, 3, and 4 provide an assessment of the selected sites in graphic form for eight of the fourteen parameters evaluated in Appendix I. All of the radiating bars that reach a length equivalent to the assessment score of "3" (to the circle) indicate an acceptable site factor. The ideal site would have a "wheel" with all spokes having a length of "3" or "4." A few are particularly excellent, and a larger number are inadequate in at least one site requirement.

On the basis of all the parameters studied the existing settlements that have the best sites are Cambridge Bay, Resolute, and Tuktoyaktuk. The poorest sites are found at abandoned DEW Line stations, notably Ekalugad Fiord, where the settlement lies 2,400 feet above sea level, five miles from the beach, and a mile from an icefield. Several small settlements, occupied as well as abandoned, have sites that prohibit expansion or easy access, especially in winter. Examples include Arctic Bay, Perry Island, and Dundas Harbour. Of the potential settlement sites analyzed the most favorable is at Radstock Bay on southwestern Devon Island. Its site is as good or better in most aspects than that at nearby Resolute. Resolute Bay is smaller, shallow in places, and susceptible to filling with ice during the period of resupply.¹⁹

CONCLUSION

The Arctic's cold, dry climate affects land, water, and man adversely. Phenomena associated with the below-freezing temperatures above and beneath the ground surface pose severe problems for construction and transportation. It is ice, on lakes, in the ground, and on the sea, that is the most important aspect of physical geography in the Arctic. Ice affects man directly and also his works. The thickness and duration of ice on a lake determine the practicability of its use as an airstrip and as a source of freshwater. Surface geology and topography may favor the building of airstrips and roads, but if the permafrost is disturbed these may soon become damaged. The great effect of drifting or solid sea ice on water transportation is well known.

With a small settlement such as a meteorological station, an airstrip of adequate length, orientation, approaches, and proximity to the settlement is probably the prime consideration. But if a large settlement must be maintained, the cost of resupply is important and sea approaches should be favorable. Both considerations are of no avail if a year-round supply of freshwater is not available or if topography, surficial geology, and permafrost conditions prevent the building of stable structures.

The increased human activity in arctic Canada requires a comprehensive analysis of the physical geography of locations where new settlements may be created. Moreover, as existing communities expand in population and services it is important that site factors be given careful consideration in decisions regarding their future.

and "Investigator Base Site Reports" (unpublished questionnaires concerning prospective and existing sites for airstrips), Department of Defence, Ottawa, 1947.

¹⁹ Detailed comparisons of these two sites have been made by Roy Jackson Fletcher (Potential Settlement Sites in the Central Arctic Archipelago [unpublished M.A. thesis, Dept. of Geography, Univ. of Minnesota, Minneapolis, 1959]) and R. F. Gajda (Radstock Bay, N.W.T. Compared with Resolute Bay, N.W.T. as a Potential Airbase and Harbour [Geogr. Branch, Dept. of Mines and Technical Surveys, Ottawa, 1964]).

APPENDIX I

ASSESSMENT OF EXISTING, RECENTLY ABANDONED, AND POTENTIAL SETTLEMENT SITES ALONG THE NORTHWEST PASSAGE

SETTLEMENT SITE (A = abandoned; P = potential)	SITE FACTORS (See key at end of table)														
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
<i>Eastern section (to Resolute)</i>															
Saglek (Labrador) (A)	3	(2)	2+	3	2+	2	1	3	1	3	2	4	3	3	
Port Burwell	1	1	2	3	3	3	1	2	1	2	2+	3	1	2	
Port Burwell (A)	0	1	2	1	3	2	1	3	1	3	2+	3	1	2	
Resolution Island (A)	0	1	2+	4	2+	3	1	3	1	3	2	4	2	2	
Cape Warwick (A)	1	1	2+	3	2	3	1	2	1	2	1	4	2	2	
Frobisher Bay	4	3	2	1	3	3	2	3	3	4	2	3	3	1	
Brevoort Harbour (A)	2	(1)	2	4	2+	2	2	2	1	3	2	4	2	2	
Pangnirtung	2	1	2+	2	3	2	1	2	3	2	2	3	4	1	
South Sakiak Fiord (P)															
65°38'N 66°40'W	2+	3	3	3	2	3	3	3	1	3	1	4	3	2	
Cape Dyer (DEW)	2+	(2)	3	4	3	3	2	1	1	3	2	4	3	2	
Durban Island DEW (A)	(2)	2	3	3	3	0	1	1	3	3	1	4	1	2	
Padloping Island (A)	3	3	2	3	2	3	3	3	3	3	1	4	3	2	
Broughton Island DEW	3	(2)	2+	3	4	2	1	(1)	3	2	2	4	3	2	
Kivito DEW (A)	2	(0)	3	2	3	3	2	(2)	3	3	1	3	3	2	
Cape Hooper DEW	2	(1)	2+	2	3+	2	2	(1)	3	3	1	3	2	2	
Ekalugad Fiord DEW (A)	0	(0)	3	2	3	2	1	1	3	3	1	3	4	2	
Clyde	3	2	2+	2	3+	2	1	1	3	3	2	3	3	2	
Pond Inlet	2+	2	2	2	1+	2	2	2	2	2	1	3	2	2	
Tay Sound (P) 72°01'N															
79°10'W	3+	2	2	3	2+	3	2	2	2	1	1	2+	3	2	
Fairweather Bay (P)															
72°11'N 80°50'W	3	3	3	3	3	1+	3	2	2	1	0	2+	3	2	
Tremblay Sound (P)															
72°21'N 81°07'W	2+	3	4	3	2	2	2	3	2	1	2	2+	3	2	
Dundas Harbour (A)	0	1	3	1	1+	0	2	1	1+	3	0	3	2	2	
Arctic Bay	0	2	3	2	3+	2	3	1	2	2	3	3	2	2	
Nanisivik	2+	3	3	2+	2+	3	2	1	2	2	0	3	2	2	
Port Leopold (P)															
73°51'N 90°17'W	4	3	3	2	2	3	3	3	1+	3	2	3	4	3	
Radstock Bay (P)															
74°42'N 91°15'W	4	4	3	3	4	4	4	3	1+	3	2	3	4	3	
Resolute	4	4	3	2	2+	4	4	2	1+	3	0	2	3	3	
<i>Western section (via southern route)</i>															
Elwin Bay (P)															
73°33'N 90°50'W	4	4	3	3	2	1	3	3	2	3	2	2	4	3	
Batty Bay (P)															
73°14'N 91°30'W	2	3	3	3	2	2	2	3	2	3	2	2	4	3	
Fort Ross (A)	0	2	2	3	2+	2	1	2	3	3	2	2	2	3	
East Baring Channel (P)															
73°50'N 98°20'W	3	3	3	3	2	2	3	3	2	2	0	1	3	3	
Bellot Cliff Bay (P)															
73°50'N 97°50'W	3	2	2	3	2	1	3	1	2	1	0	1	3	3	
North Backs Bay (P)															
73°33'N 97°30'W	4	3	3	3	3	2	3	2	2	3	1	1	4	3	
Kennedy Bay (P)															
72°02'N 96°45'W	4	3	3	3	3	2+	2+	2	3	2+	2+	1	3	3	
Willis Bay (P)															
71°56'N 96°30'W	4	2	3	2	4	1	2	2	3	2	3	1	3	3	
Weld Harbour (P)															
71°02'N 96°24'W	3	3	3+	3	3+	2	2	2	3	2	4	2	3	3	
Spence Bay	(3)	2	3	3	3	4	2	2	3	2	2	2	4	4	
Sheperd Bay DEW	4	(2)	2+	2	1+	2	3	(2)	3	3	0	2	3	4	
Matheson Point DEW (A)	2	(1)	3	3	2	2	2	2	3	3	0	2	4	4	
Gjoa Haven	3	2	3	4	2+	2	3	2	3	3	3	2	3	3	
Gladman Point DEW	4	3	3	3	2	3	3	4	3	3	1	2	4	3	
Smith Point Peninsula (P)															
68°24'N 98°28'W	3	3	3+	3	1	2	4	4	3	1	1	2	3	4	

APPENDIX I—Continued

SETTLEMENT SITE (A = abandoned; P = potential)	SITE FACTORS (See key at end of table)													
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Hat Island DEW (A)	(2)		3	3	2	4	3	3	3	3	1	2	3	3
Jenny Lind Island DEW	3	(2)	2+	2	2+	2	3	2	3	3	1	2	3	3
Perry River (Flagstaff Island) (A)	0	1	3	3	2+	1	2	2+	3	2+	2+	2	3	3
Perry Island (A)	0	1	2+	1	2+	2	1	2	3	2	2	2	2	3
Sturt Point DEW (A)	(2)	3	2+	2	1+	3	2	2+	3	3	0	2	2	3
Cambridge Bay	3	4	2+	3	2+	3	2	3	3	3	3	2	3	3
Cape Peel DEW (A)	1	(2)	3	2	2	3	3	2	3	4	0	2	3	3
Byron Bay DEW	(3)	(2)	4	1	2	3	3	2	3	4	0	2	4	3
Bathurst Inlet (A)	3	2	3	0	1+	1	1	1	3	1	2	2	3	4
Baychimo	:	2+	3	2	3	3	1	2+	3	2+	2	2	3	4
West Daniel Moore Bay (P)														
67°45'N 109°40'W	3	2	2+	3	2+	2	2	2+	3	2	3	2	3	4
Port Epworth (P)														
67°42'N 111°58'W	1+	(2)	3	1	4	3	3	2	2+	2	4	2	3	3
Ross Point (A)	2	(1)	2+	2+	3+	4	2	2	3	3	2	2	4	4
West Johansen Bay (P)														
68°34'N 111°24'W	4	3	2+	3	3+	3	3	2	3	3	3	2	4	4
Coppermine	3	2	2+	1	2	3	2	2	2+	2	1	2	3	4
Basil Bay (P)														
68°16'N 114°55'W	4	3	3	3	2	1	3	2	2+	2+	2	2	3	4
Lady Franklin Point DEW	3	3	3	2	2	3	3	4	2+	3	0	2	3	4
Bernard Harbour DEW (A)	(3)	2	3	3	1+	3	1	2	2+	2	3	2	4	4
Read Island (A)	2	3	3	3	2	1	3	3	2	3	1	2	3	3
Lady Richardson Bay (P)														
69°34'N 116°45'W	3	3	3	3	2+	2	2	3	2	2	3	2	4	4
Cape Young DEW	4	3	3	2	2	2	3	2	2	1	0	2	4	4
Clifton Point DEW (A)	3	2	2+	2	2	3	2	4	2	2	0	2	3	4
<i>Western section (via northwest route)</i>														
Bay east of Freemans Cove (P)														
75°12'N 97°45'W	3	3	2+	3	2	2	2	2+	2	3	4	0	3	3
West Hooker Bay (P)														
75°10'N 100°35'W	4	3	3	3	3+	2	4	2+	2+	1	2	0	3	3
West Bridport Inlet (P)														
75°03'N 108°55'W	2	2	3	1	4	1	2	2+	3	3	4	0	3	3
Johnson Point	3	3	2+	3	2+	3	3	2	2+	3	1	1	2	4
Deans Dundas Bay (P)														
72°17'N 118°03'W	3	3	3	1	2	3	3	2	2+	3	1	1	4	4
Jesse Harbour (P)														
72°15'N 120°10'W	2+	3	2+	2	2+	2	2	2	2+	3	4	1	3	4
<i>Western section (common to both routes)</i>														
Holman	2	1+	2+	3	3	3	1	2	2+	2	2	2	2	4
De Salis Bay (P)														
71°25'N 121°35'W	3	3	3	3	3+	3	2+	4	2	2	2	2	3	4
Sachs Harbour	3	2	2+	3	2	3	1	2	2	2	3	1+	2	4
Clinton Point DEW	4	(3)	3	3	2	3	4	3	2	2	0	2	4	4
Pearce Point DEW (A)	2	(0)	(2)	3	2+	2	(1)	(1)	2	0	3	2	4	4
Paulatuk	3	3	2+	3	2	4	3	4	2	1	3	2	3	4
West Darnley Bay (P)														
69°42'N 124°29'W	3	3	3+	3	2	3	3	4	2	2	0	2	3+	4
Letty Harbour (A)	2	1	2+	2	2+	2	1	2	2	2	0	3	2	4
Cape Parry DEW	3	(1+)	2+	3	2+	3	2	2	2	1	(0)	2	3	4
Old Channel DEW (A)	3	3	3	2	2	3	0	1	2	2	0	2	3	4
Nicholson DEW	3	(1)	2+	1	1+	3	2	3	2	2	0	2	3	4
Atkinson Point DEW (A)	2	(2)	2+	0	2	3	2	3	2	2	2	2	3	4
Tuktoyaktuk	3	3	2+	3	2+	3	3	3	2	3	4	2+	3	4
Swimming Point	3	3	3	2	1	4	2½	4	2	4	4	2+	3	4
Tununuk DEW (A)	2	1	2+	3	2	3	1	4	2	4	2+	3	4	4

APPENDIX I—Continued

SETTLEMENT SITE (A = abandoned; P = potential)	SITE FACTORS (See key at end of table)													
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Shingle Point DEW	2	3	3	0	1	2	1	3	2	3	0	2	3	4
Stokes Point DEW (A)	(2)	(2)	3	2	1	3	3	3	2	2	0	2	3	4
Hershel (A)	3	2	3	3	2+	1	2	2	2	2	0	2	3	4
Komakuk DEW	3	3	2	3	1+	3	3	3	2	2	0	2	3	4

Key to site factors:

- A = Suitable airstrip area, air approaches, and orientation to prevailing winds: area (not length of existing runway) to be: 1 = 1,000–2,500 feet; 2 = 2,500–4,000 feet; 3 = 4,000–10,000 feet; 4 = 10,000 feet or more
- B = Large and flat building site
- C = Favorable permafrost and surficial geology for construction of airstrip and buildings
- D = Deep and unobstructed water approaches to landing beach
- E = Large, deep, and sheltered harbor with good anchor holding
- F = Year-round supply of good-quality freshwater
- G = Large, gently sloping gravel landing beach
- H = Close proximity of freshwater supply, landing beach, building site, and airstrip site
- I = Few days when aircraft operations hampered by poor visibility and low ceiling: percentage of days per year of visibility of 3/8 mile or less and ceiling of 500 feet or less: 1 = 5 or more; 2 = 2–4; 3 = less than 2
- J = Favorable prevailing winds for ice removal from landing beach and harbor
- K = Narrow harbor entrance and large stream entering bay
- L = Relatively long navigation season for vessels escorted by an icebreaker (medium-sized ice floes covering less than 80 percent of the surface): 1 = less than one month; 2 = one or two months; 3 = more than two months
- M = Sand and gravel for construction relatively near settlement site
- N = Low tides to facilitate off-loading: 1 = spring tide range of more than 25 feet; 2 = 6.1–25 feet; 3 = 2–6 feet; 4 = less than 2 feet

Key to values (unless otherwise indicated under specific site factors):

- 0 = Definitely not acceptable for a potential site and very poor for an existing settlement
- 1 = Poor, but may meet the requirements
- 2 = Not good, but could be improved with considerable effort or would probably suffice
- 3 = Meets the requirements under this heading
- 4 = Superb qualifications under this heading
- () = Present or abandoned site has this assessment value, but a better (higher value), unutilized site is available nearby

CORPORATE DOMINANCE OF MANUFACTURING IN APPALACHIA

THEODORE KLIMASEWSKI

GEOGRAPHERS and planners have become increasingly aware that the location of a manufacturing operation in a rural area does not necessarily result in long-term economic growth in the area.¹ Community leaders of small towns and rural places, however, expect increases in manufacturing to create economic advancement in places close to the new manufacturing plants.² They anticipate that new manufacturing operations will bring additional revenue to the town coffers, will increase business in the retail and service sectors, will provide employment for local people, and will encourage other manufacturing plants to locate nearby.

Support for the conventional notion that manufacturing means growth comes from traditional theories in regional economics, which purport that a new industrial enterprise will entice other factories to locate nearby for the exchange of inputs and outputs and will employ people who, in turn, will spend their wages in local retail outlets.³ Although this sequence of events is supposed to establish an advanced economic environment, the character of manufacturing activity in certain rural places works against long-lasting economic advancement.⁴ Manufacturing in rural areas often generates little intraregional exchange of revenue and resources because plants are attached to other places throughout the nation.⁵

A case study of one rural area in Appalachia shows that the corporate and input-output linkages of forty-nine establishments extend beyond the rural area and regional centers to the detriment of the area. In this rural study area, most manufacturing operations obtain inputs largely from the core of the nation and from the Piedmont of the South. Marketing of retail and industrial outputs is largely linked to the core. The core in this study consists of the Northeast and Midwest, as defined by the Census Bureau.⁶ As this study further shows, geographical linkages to the core are strongly influenced by small consumer-industrial markets and by few complementary industries in the rural area, coupled with corporate affiliation. Partly because of the dominance of national corporations over their branch plants, manufacturing operations never stay long enough to establish intraregional linkages. As a result of the external character of industry in the rural area, long-lasting economic gains through an intraregional exchange of manufactured products are minimized. The rural area of Appalachia therefore maintains its low income levels under this form of corporate dominance.⁷

¹ Gene F. Summers: *Small Towns Beware: Industry Can Be Costly*, *Planning*, Vol. 42, 1976, pp. 20-21.

² "What New Jobs Mean to a Community" (Chamber of Commerce, Washington, D.C., 1973), pp. 3-11.

³ Peter E. Lloyd and Peter Dicken: *A Theoretical Approach to Economic Geography* (Harper & Row, New York, 1972), pp. 163-167; and Allan R. Pred: *The Spatial Dynamics of U.S. Urban-Industrial Growth, 1800-1914* (M.I.T. Press, Cambridge, Mass., and London, 1966), pp. 24-37.

⁴ Richard E. Lonsdale: *Barriers to Rural Industrialization in the South*, *Proc. Assn. of Amer. Geogr.*, Vol. 1, 1969, pp. 84-88.

⁵ Edgar M. Hoover: *The Location of Economic Activity* (McGraw-Hill Book Company, Inc., New York, Toronto, and London, 1948) pp. 145-165; and Charles L. Leven: *Establishing Goals for Regional Economic Development*, *Journ. Amer. Inst. of Planners*, Vol. 30, 1964, pp. 99-105.

⁶ The Northeast comprises the New England states, New York, Pennsylvania, and New Jersey. The Midwest includes states west of Pennsylvania, north of the Ohio River, and east of the Mississippi River.

⁷ John Friedmann: *Regional Development in Post-Industrial Society*, *Journ. Amer. Inst. of Planners*, Vol. 30, 1964, pp. 84-90.

THE STUDY AREA

To determine whether or not the concept of corporate dominance operates in rural Appalachia, an area was selected for study which comprised eight counties in East Tennessee.⁸ The area is like much of rural Appalachia in that manufacturing activity and employment have been increasing yet the essential rural character and poor economic performance have changed little.

More specifically, the study region manifests six significant characteristics. The counties have no towns with more than 7,000 people.⁹ The counties are outside any Standard Metropol-

TABLE I—SOCIAL AND ECONOMIC CHARACTERISTICS OF THE EAST TENNESSEE STUDY AREA

COUNTY	PERCENTAGE OF TOTAL EMPLOYMENT IN MANUFACTURING	PERCENTAGE OF RURAL AND RURAL NONFARM	MEDIAN INCOME (in dollars)	PERCENTAGE OF POPULATION UNDER POVERTY LEVEL
Campbell	28	73	4,389	36
Claiborne	25	100	4,266	39
Cumberland	34	74	4,476	29
Fentress	36	100	3,937	42
Grainger	42	100	5,082	30
Morgan	43	99	5,363	27
Scott	33	83	4,172	42
Union	39	100	5,005	34
UNITED STATES	25	27	9,586	11
ALL TENNESSEE	31	41	7,447	18

Source: "U.S. Census of Population, 1970 General Population Characteristics" (U.S. Bur. of the Census, Washington, D.C.).

itan Statistical Area. The number of manufacturing plants containing twenty-five workers or more rose from twenty-one in 1949 to fifty-three in 1972.¹⁰ The proportion of employment in manufacturing is greater than the national average of 25 percent (Table I). In all eight counties, the population is at least 70 percent rural, which is higher than percentages for Tennessee and the United States. Median incomes for each of the eight counties range from 25 to 40 percent below the median income for Tennessee and from 40 to 60 percent below the median income for the United States. The percentage of population having incomes below the poverty level for 1969 is generally twice the level for the state and three to four times the figure for the nation. The Appalachian Regional Commission designated the eight counties as having a high incidence of poverty in 1970.¹¹ Projections to 1980 by the commission indicate that six counties are expected to continue to have a high incidence of poverty. Thus, increases in manufacturing have failed to offset the characteristically low income levels.

⁸ Data for this study were gathered from eighteen trips to the study region between April and August, 1973. All manufacturing plants in the study region that employed twenty-five workers or more were visited. Only one plant official refused to be interviewed. The study region was chosen because it represents one of the poorest clusters of rural counties in the nation that experienced a recent increase in manufacturing.

⁹ The figure of less than 7,000 population was chosen partly because Lonsdale and Browning suggested that their definition of a rural place as one with 5,000 people might be too narrow for some regions. Industrial planners in Tennessee indicated to me that towns of 7,000 population can be considered rural communities. Federal legislation, such as the Rural Development Act, considers towns of 25,000 people or less to be rural communities. See Richard E. Lonsdale and Clyde E. Browning: Rural-Urban Locational Preference of Southern Manufacturers, *Annals Assn. of Amer. Geogr.*, Vol. 61, 1971, pp. 255-268, reference on p. 263.

¹⁰ "Directory of Tennessee Industries" (Tennessee Div. of Industrial Development, Nashville, 1949); "Tennessee Directory of Manufacturers" (Tennessee Div. of Industrial Development, Nashville, 1973).

¹¹ Jerome P. Pickard: Poverty Trends in the Appalachian Region, *Current Regional Repts.*, No. 5, Appalachian Regional Commission, Washington, D.C., 1973.

REGIONALIZATION OF INPUTS AND OUTPUTS OF MANUFACTURING PLANTS IN THE EAST TENNESSEE STUDY REGION

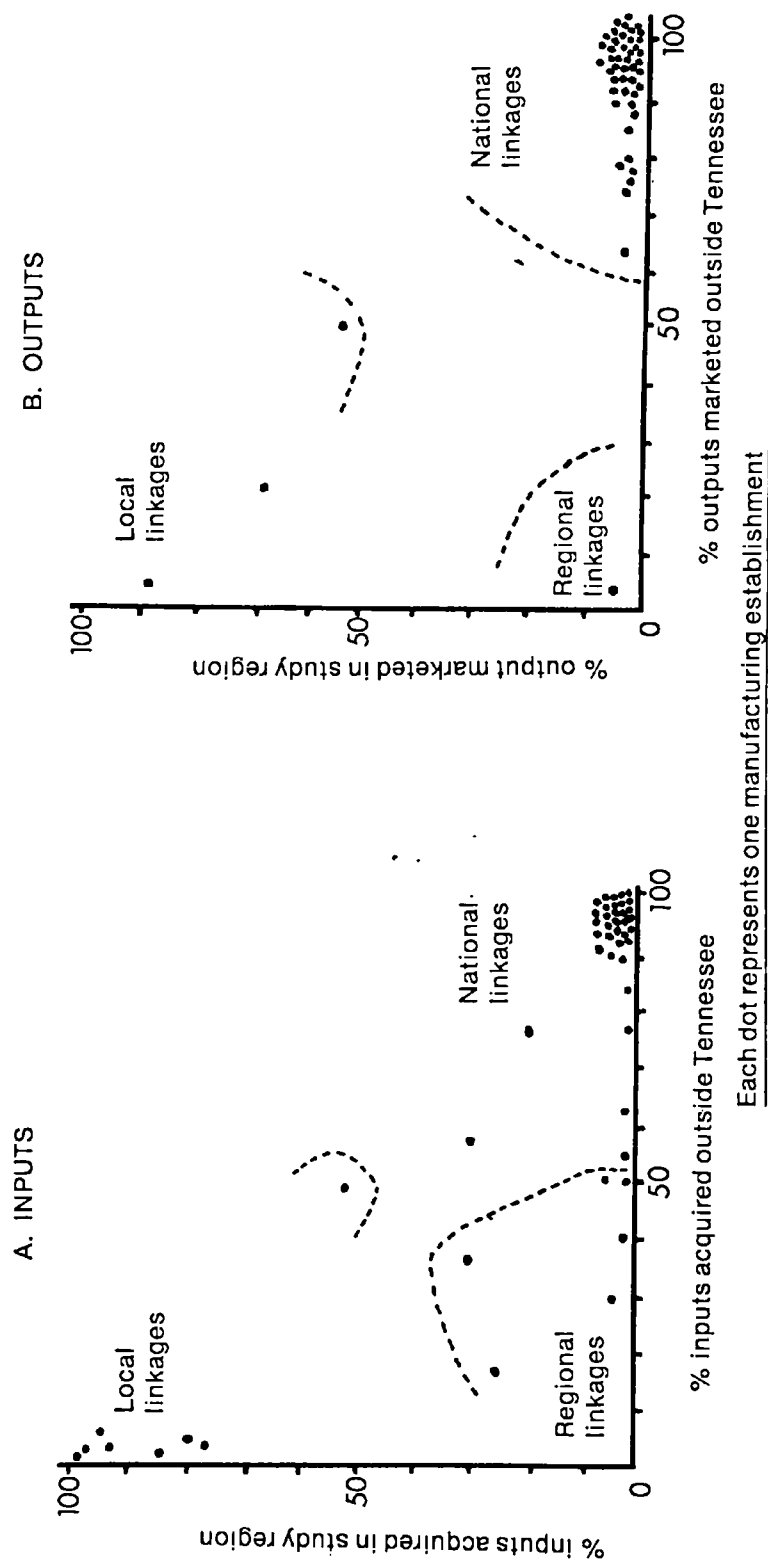


FIG. 1

REGIONALIZATION OF INPUT AND OUTPUT LINKAGES

A simple technique was used to illustrate geographical linkages in the study area. Entrepreneurs and plant managers of the forty-nine establishments in the study area were asked to estimate that percentage of their production materials which they acquired in the South, the Northeast, the Midwest, and the West, respectively. They were also asked to estimate the percentages of products marketed in the various regions.

Discriminant analysis was used to group establishments into classes of plants that acquire a predominant share of inputs on a local (Class I), state (Class II), or national (Class III) scale. Discriminant analysis was also used to group establishments according to their pattern of marketing. Next, the following formula was used to calculate labor coefficients for inputs and outputs:¹²

$$LC_{ir} = \sum_{i=1}^n (E_{ir} \times P_{ir})$$

where E_{ir} is the number of workers in each establishment for any particular group of industries in the study region; P_{ir} is the percentage of inputs (or outputs) acquired (or marketed) in the study region and in other regions in Tennessee and the United States for each establishment in any particular industrial group; and LC_{ir} is the labor coefficient for all establishments in any particular industrial group allocated to the study region or to regions in Tennessee and the United States.

The coefficients for each class were summed for each geographical division to measure the magnitude of linkages to the local area, to regional centers, and to places beyond Tennessee. The labor coefficient, which is a summation of the number of workers multiplied by the percentage of production materials (or products) acquired (or marketed) in a region, provides a simple technique to determine the magnitude of input-output linkages between manufacturing establishments in the study region and in places beyond the study area.

Only eight Class I establishments acquire a large share of their inputs from local sources (Fig. 1). Most of these inputs are farm goods and raw materials such as stone or lumber. The six factories in Class II purchase a large portion of their inputs from regional centers in East and Middle Tennessee; most are minor inputs, such as farm products, lumber, or boxes, from regional centers.¹³ Except for strong linkages between two plants and their parent companies in East Tennessee, Class II firms have input linkages that do not generate substantial industrial linkages. In fact, input linkages within the study area and Tennessee are insignificant for all forty-nine plants in the three classes. Table II shows that by adding a labor coefficient of 629 in the study area and 1,036 on the regional scale for forty-nine plants in all classes there is a relatively low labor coefficient of 1,664 out of 8,121. The low coefficient for purchases of inputs verifies the relative unimportance of input linkages to the study area and Tennessee.

The strongest linkages for inputs are on a national scale for the thirty-five Class III establishments. After calculating labor coefficients for these thirty-five plants, it was determined that more than half (54 percent) of the total labor coefficients for these plants are a result of purchases made in the South. The input linkages are predominantly between the largest employers (that is, apparel, textile, and furniture industries) in the study region and factories located in the Piedmont of North Carolina and northern Georgia. A fifth (21 percent) of the total labor coefficient for these Class III plants is accorded to the industrial-commercial core of the Northeast and Midwest. Most of the purchases in the core are manufactured inputs; most of the inputs secured in the study region and Tennessee are nonmanufactured. The remaining

¹² W. Lee Hansen and Charles M. Tiebout: *An Intersectoral Flow Analysis of the California Economy*, *Rev. of Econ. and Statistics*, Vol. 45, 1963, pp. 409-418.

¹³ The discriminant analysis placed two establishments in Class II on the basis of input purchases, but a closer study of the two plants indicated that they belonged in Class III. Both plants had minor regional linkages, whereas more than half of their inputs were major production materials purchased from places outside Tennessee.

inputs emanate from states west of the Mississippi River or from foreign imports, largely nonmanufactured products such as farm goods and lumber.

Output, or forward linkages, consists of sales of finished products to retail firms and sales of intermediate products to other processors. Direct sales are emphasized because this study is

TABLE II—SUMMARY OF LABOR COEFFICIENTS

CLASS OF PLANT	NUMBER OF PLANTS	NUMBER OF EMPLOYEES	LABOR COEFFICIENT		
			Local	Regional	National
Inputs					
I	8	470	403.18	45.31	21.52
II	6	1,041	98.00	563.50	379.50
III	35	6,610	127.97	427.32	6,054.15
TOTAL	49	8,121	629.15	1,036.13	6,455.16
Outputs					
I	3	131	87.25	10.50	33.25
II	1	56	0	56.00	0.00
III	45	7,934	29.59	379.35	7,525.06
TOTAL	49	8,121	116.84	445.85	7,558.31

concerned with direct forward linkages rather than with the complex chain of linkages by which products filter through a number of secondary handlers.

Only four of the forty-nine establishments market a relatively large share of their products in the study region or in Tennessee. The three Class I enterprises manufacture inputs for mining operations, building contractors, and the Department of Agriculture. A textile branch plant, the only Class II establishment, produces inputs for its parent company in East Tennessee. Altogether the four plants employ only 187 workers. Class III, as depicted in Figure 1, contains forty-five establishments which market most of their products outside Tennessee. Thirteen of the forty-five establishments produce intermediate goods for other manufacturers, and thirty-two manufacture finished goods for retail markets. The core, a significant market area in the Northeast and Midwest, attracts a large share of the national linkages for intermediate and finished products manufactured in Class III plants. Half of the labor coefficient (4,214 out of 7,525) for outputs marketed on a national scale is attributed to markets in the Northeast and the Midwest (Table II). Most linkages are to retailers and manufacturers in the Midwest, whereas a smaller amount of output is shipped to the Northeast. The South ranks behind the Northeast and the Midwest in the amount of products marketed; most of the output marketed in the South is sent to apparel, textile, furniture, and mobile-home industries.

A query of forty-nine plant officials provides at least a cursory view of why geographical input-output linkages catenate to the industrial-commercial core and to certain parts of the South rather than to the study region or to regional centers in Tennessee. According to forty-five of the entrepreneurs and plant managers, production materials are purchased nationally for two principal reasons: there are few establishments in the study region to supply production materials, and backward linkages originate from places where parent companies are located. Furthermore, in the view of more than three-quarters of the entrepreneurs, national markets are more attractive than local or regional markets because actual and potential demand is strong in the core, because local manufacturers of intermediate products find few factories in the study region to buy their products, because finished and intermediate products are contractually bound to parent companies and to national retail firms, and because knowledge of potential markets in the study region and regional centers is generally lacking.

LOCATION OF COMPANIES WITH BRANCH PLANTS IN THE EAST TENNESSEE STUDY AREA

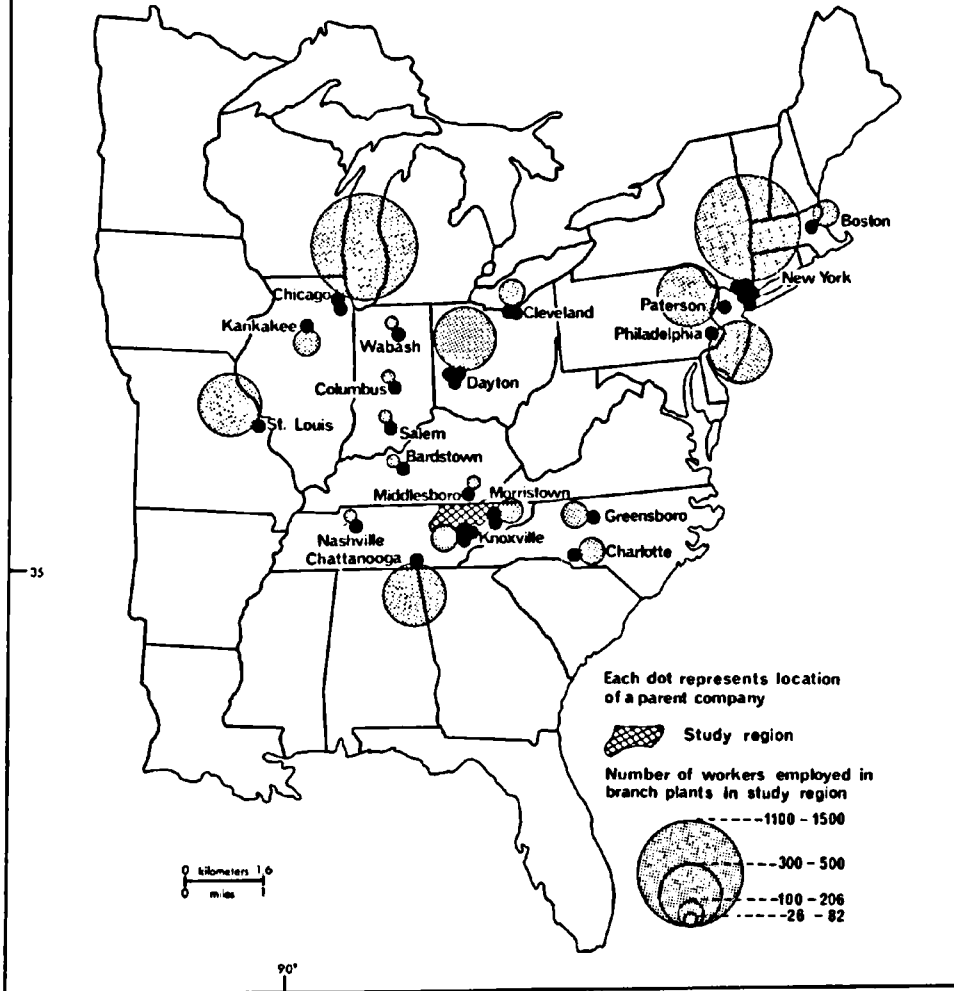


FIG. 2

CHARACTERISTICS OF MANUFACTURING ESTABLISHMENTS

The small size of the manufacturing enterprises and their organizational structure, their sources of capital, and their ephemeral nature augment the effects of geographical linkages and corporate affiliations (Table III). Theoretically, large plants that provide large quantities of production materials for local ancillary plants generate the strongest intraregional linkages.¹⁴ If

¹⁴ Morgan D. Thomas: Growth Pole Theory: An Examination of Some of Its Basic Concepts, in *Growth Centers in Regional Economic Development* (edited by Niles Hansen; The Free Press, New York, 1972), pp. 50-81, reference on pp. 62-63.

TABLE III—CHARACTERISTICS OF MANUFACTURING ESTABLISHMENTS

CHARACTERISTIC	NUMBER OF ESTABLISHMENTS
Type of Products	
Retail products	33
Intermediate products	16
Size of Establishments	
Large (250 employees or more)	10
Medium large (100 to 249 employees)	14
Medium small (50 to 99 employees)	15
Small (25 to 49 employees)	10
Ownership of Establishments	
Branch or absentee-owned	34
Local ownership	15
Source of Capital	
Outside study region	35
Within study region	14
Fixed Capital: Ownership of Buildings	
Privately owned	30
Publicly owned	12
Leased	7
Duration of Operation	
10 years or less	29
11 to 20 years	14
21 to 30 years	3
More than 30 years	3

employment is used as a surrogate for size of plants, few large plants exist in the study region. The definition of small factories by the Small Business Administration includes establishments with 250 workers or fewer; thirty-nine factories are in the category of small operations.¹⁸ To offset the advantages of even the large plants, the proclivity of large factories is to ship to retail markets rather than to other factories. In fact, eighteen of the twenty-four largest plants produce finished products for the retail markets. The remaining large establishments ship to other factories, but they market more than four-fifths of their products outside Tennessee. The relatively small number of large plants and the particular production function of the large plants offer little opportunity to generate strong local linkages or to attract any large number of ancillary factories.

Two-thirds of the factories in the study region are branch plants. The significance of the corporate ties is illustrated by the fact that branch plants, most of which have parent companies in the Northeast and the Midwest, employ 78 percent of the workers in the forty-nine plants in the study area. The Midwest is the corporate headquarters for twelve branch plants, whereas eight branch plants have parent companies in the Northeast (Fig. 2). The branch factories in the Midwest and the Northeast employ 62 percent of the workers, and one-third of the employment is in branch plants of parent companies located in New York and Chicago.

Even though eleven establishments have organizational ties with the South and with Tennessee, they employ only 17 percent of the workers in this study. The corporate linkages

¹⁸ Clifford M. Baumbach, Kenneth Lawyer, and Pearce C. Kelley: *How to Organize and Operate a Small Business* (Prentice-Hall Inc., Englewood Cliffs, N.J., 1973), pp. 4-6.

with the South include two apparel companies in the North Carolina Piedmont and a lime operation and a mobile-home enterprise in Kentucky. The organizational linkages in Tennessee reach to cities in East and Middle Tennessee. Generally, the branch plants with attachments in Tennessee are small operations.

The other eighteen plants in this study are locally owned operations initiated by people who have either lived in the area for some time or moved into the region in recent years. Most locally owned establishments are small, and together they employ only 21 percent of the work force in the region. Significantly, three locally owned enterprises have organizational linkages with national wholesalers and retailers through contract work, and two local entrepreneurs have geographical linkages reaching into areas where they once resided.

The organizational ties between branch plants in the study region and parent companies located in cities of the Northeast and the Midwest strongly bias the territorial linkages of these plants to parent companies, to factories near the parent company, or to national retail outfits. Even most locally owned firms are tied to places outside the study region through contract work.

Another indicator of the organizational linkages to places outside the study region is the source area for capital. In this study, a strong association exists between the location of parent companies and the sources of capital of branch plants (Table III). Of the thirty-five plants that secure capital beyond the study area, twenty-two acquired their capital in the Northeast and the Midwest, which corroborates the organizational attachments to these regions. Five plants secured their capital investment in the South, and eight in Tennessee cities. The remaining capital investment for fourteen local entrepreneurs came from bank loans, family fortunes, partnerships, or the process of incorporation.

Manufacturing plants need a prolonged period of time to build linkages with new establishments or exchange goods with factories already in existence.¹⁶ In this study, 87 percent of the establishments have existed for less than twenty years (Table III). Sixty-three percent have been in operation for less than 12.4 years, which is the average length of operation for all plants established in the past twenty-five years, and 59 percent have had a life-span of ten years or less.

Another measure of the temporariness of individual manufacturing operations is the survival rate over the past twenty-five years. The total number of plants in operation increased between 1949 and 1974, but turnover was substantial. Of the 109 plants that employed twenty-five workers or more during the period, fifty-four plants were in existence in 1974, whereas fifty-five plants had closed down.¹⁷ Even though an increase in the total number of new plants occurred between 1949 and 1974, discontinuation of operations increased over the years.¹⁸ This turnover of establishments makes it difficult to build intraregional linkages.

The ephemeral nature of a manufacturing enterprise depends partly on certain inertial forces, such as the amount of fixed capital tied up in buildings and machinery.¹⁹ In the study region, inertial forces of fixed capital investment are weak for the twelve companies that use buildings owned wholly or partially by a county or community. The fixed capital in buildings is also negligible for the seven companies that rent buildings from private persons. The renting of buildings has probably helped to bring some low-profit-margin firms into the area, but under the renting conditions, 39 percent of the plants could easily migrate from the rural area at minimal expense. Significantly, nine of the twelve county-owned buildings contain large

¹⁶ Thomas, *op. cit.* [see footnote 14 above], pp. 74-76.

¹⁷ Six of the fifty-four plants in existence did not employ twenty-five workers or more in 1974, but at one time they did employ at least twenty-five workers. Unsuccessful manufacturing enterprises in this study had a tendency to decrease their number of employees before shutting down the operations.

¹⁸ The rise and decline in the number of factories were calculated from the "Directory of Tennessee Industries" and "Tennessee Directory of Manufacturers" [see footnote 10 above]. These sources listed the names of individual establishments for the years between 1949 and 1974.

¹⁹ Hugh O. Nourse: *Regional Economics* (McGraw-Hill, New York, 1968), p. 205; and David M. Smith: *Industrial Location* (John Wiley & Sons, New York, 1971), pp. 38-39.

branch plants that have been in existence for less than ten years, and the seven leased buildings contain plants in existence for an average of seven years. The short duration of these plants, as well as their limited capital commitments, is indicative of their potential mobility.

PLANNING ALTERNATIVES

Since the study area does not have enough economic advantages and institutions to alter substantially its geographical and organizational linkages to places in the Northeast and the Midwest, most planning for industrial development appears to be peripheral and stopgap rather than long-term. Investments in infrastructure, building of factories with local funds, and tax subsidies may attract some plants, but these projects are probably futile for generating economic growth over a long period. Thus, short-term and long-term planning policies are not one and the same.

Short-run policies should be concerned with realistic adjustments of local people to high turnover of factories. For example, policies may include the design of buildings to accommodate different types of operations or the recruitment of nondurable goods industries with contractual arrangements to national retailers. For the long-term, policies should encourage the upgrading of skills, with a concomitant recruitment of high-wage industries. Another long-term goal is to tie rural factories into the industrial economy of regional growth centers. Rural industries would be feeders to plants in the growth centers. The complementarity between growth centers and rural hinterlands should also facilitate the contact of rural workers with better jobs in growth centers.

In devising programs, planners must recognize the importance of careful selection of manufacturing plants for rural areas, vocational education programs, and the advertisement of industrial markets and job opportunities in the growth centers. The plans to achieve this goal, however, must be structured to include the corporate decision-making process as it affects a rural area.

GEOGRAPHICAL REVIEWS

HUMAN GEOGRAPHY: Evolution or Revolution? By MICHAEL CHISHOLM. 207 pp.; maps, diagrs., bibliogr., indexes. Penguin Books, Ltd., Harmondsworth, Middlesex, 1975. £1.00; \$4.95 (paperbound). 7 1/4 x 5 inches.

This small paperback is addressed to a wide audience of students and interested lay readers. In separate statements the author, Michael Chisholm, expresses two different but related purposes: "to convey my own picture of how geography in general, and human geography in particular, has evolved to its present state and position"; and "to provide students and the interested lay reader a filter to diffuse downward the exponentially increasing flow of information in geography."

The main part of the text, some two-thirds the total, serves particularly the second purpose, presenting a large number of new concepts and techniques of "modern" geography (that of the past thirty years). Each of more than a score of topics is presented with specific examples and graphs; and references to more than 150 studies in the literature in English, predominantly that of British students, are provided. Included are such matters as nearest-neighbor technique, trend-surface filling, regionalization, space-time budget, game theory, diffusion studies, perception studies, and normative and positive theories. For the most part these are the products of the "quantitative revolution" and of what critics have called "scientism in geography"—that is, the attempt to convert geography to the "scientific paradigm, the hypothetico-deductive frame of reference," modeled after such sciences as physics. I found the presentation of these topics stimulating and usually clear, but I confess to some confusion when the term "normative" is applied both to W. M. Davis's theory of "the geographical cycle" as an "ideal" of how a landscape "should" evolve and to "what should be an ideal world, or even merely a better one."

Not all of Chisholm's topics are as new to geography as he would have the reader believe. Some of us were studying flow patterns and location theory fifty years ago. The idea of regions as a form of classification was clearly recognized in the 1930's in respect to "generic regions"; it cannot be applied to "specific regions."

In reading the presentation of developments in geography before 1950, it is especially important to remember Chisholm's statement that the account must be regarded as "highly personal." Yet little appears to be based on firsthand knowledge of the works discussed. Instead, the author appears to depend on a few secondhand and thirdhand sources.

The account is presented largely in generalizations, some evidently from *a priori* models. We are told that before 1950 geographers viewed location as absolute geometric distance and azimuth, fixed and unchanging, between any two points as determined by latitude and longitude, rather than in terms of cost, time, or other variables. An opposite view, I would suggest, may be found in the writings of Carl Ritter, Friedrich Ratzel, and Ellen Churchill Semple—not to mention countless later writers.

The presentation by topics, overlapping in chronology, results in some confusion. The work of individual geographers, or groups of geographers, is trimmed or distorted to fit the generalized pattern. Thus, to fit in a stage of development of geography concerned with the gathering of facts, Alexander von Humboldt and Carl Ritter are pictured merely as having laid "the foundations of scientific description" in geography by relating carefully measured and verified observations of facts. Nothing is said of the aspect of their work that each of them repeatedly emphasized, and that later students regarded as of most importance: namely, the study of interconnections, of the areal associations of multitudinous kinds of phenomena, both physical and human. Following a common error, Chisholm construes the environmentalist concept of geography—the study of the relationships between man and the natural environment—to be environmental determinism: "that in human behavior all first causes lie in the physical environment."

The evolution of geography from the days of field exploration and the portrayal of data on maps led, we are told, to the implicit habit of considering in geography only phenomena that are visible or otherwise tangible, or measurable in the field. No references are given, and the one example is a poor one to show "the fallacies to which this mode of thinking can lead." It includes a map based on "commercial value of products," and the explanation of the pattern includes the very factors allegedly ignored: location of main urban markets, government tariffs, and competition from abroad.

The theme which occupies more attention than any other in this history of geography before 1950 is that of the influence of the holistic concepts of nineteenth-century German philosophy on geography. Geographers who failed to find scientific laws in the framework of environmentalism were attracted, we are told, by the concept of "oneness," or the "wholeness" of things, in which the whole is something more than the sum of its parts. If geography studies unique events (places) that cannot be predicted, the events can be related to the total system of which they are a part, whether in a region considered as a whole or in larger units. Acceptance of this concept blinded geographers to the distinction between things metaphysical, which are matters of faith, and things which are amenable to scientific analysis. The consequences can be seen in various ideas that geographers developed concerning the region, or *Landschaft*, such as "the totality of the phenomena and their interrelationships," the region as an objective reality, and so forth. No work is identified as promoting these views about regions, but parenthetical references to three sources, in the midst of the discussion, may well lead readers to suppose that those works support the views under discussion. Chisholm fails to note that the ideas in question are refuted at considerable length in the sources cited.

More generally, the author describes geography in the period before 1950 as representing "a somewhat mystical or romantic view" rather than one "based on accepted canons of scientific method." This is based not on inductive evidence from the writings but on deductive theory traced through a complicated genetic history. In brief: a "holistic" concept presented by the German philosopher Hegel was adopted, "in the name of Kant," by German geographers, "especially by Hettner who in turn exerted a major influence upon Hartshorne." The inclusion of Immanuel Kant in the sequence is confusing, since his work antedated that of Hegel, and disruptive, since the view attributed to him, concerning the unique and laws in geography, has been specifically demonstrated to have been one of the many fabrications in the paper from which it is cited. On the crucial question—whether Hettner, who had studied in philosophy as well as geography, followed Hegel's philosophy in general or the holistic concept in particular—no evidence is offered. Yet much evidence is available to demonstrate a negative answer in both respects.

The study of unique cases, a major aspect of geography from earliest times, is treated as a weakness before 1950 but is apparently nonexistent in the new "scientific" geography. To avoid the misconceptions that commonly result from the use of so short a phrase, I suggest that what is in question in geography is the role of studies of individual places (areas or regions), each considered in terms not only of characteristics it shares with others in a class but also of characteristics unique to it. The answer of scientism is to omit any mention of the question: Chisholm ignores the concept of "specific regions." Carl O. Sauer's study of the origin and dispersal of Old World agriculture is presented as a classic predecessor of diffusion studies under the heading of "Theories of Spatial Process," with no apparent awareness that it is essentially a study of a unique event in a unique area. The exception is significant: in historical geography, as in history, the study of unique events in time is accepted as "eminently worthwhile and beguiling," but evidently the study of unique areas is not. If the new geography is thus to reject what has hitherto formed a large part of the field, it must be prepared to answer the question of whether the remaining disparate parts are not logically the concern of other sciences, each of which investigates the spatial aspects of the kind of phenomena that it studies—as in fact has been the case with respect to economics and location theory.

I have given so much critical attention to Chisholm's account of developments in geography because it is much more than one man's personal view. In substance and in manner of

reporting it reflects attitudes and thoughts expressed in the writings of numerous other proponents of scientism in geography. Thus it is not enough to present what is believed to be new and worthwhile in geography since 1950; what went before must be made to look greatly inferior. As familiar as this technique is in certain forms of political writing, I should hardly expect it to be effective in earning respect for the subject from workers in other fields. Until everything worth knowing can be expressed in quantitative terms, mathematical formulas, and symbolic logic, we will have to continue to communicate also with words and therefore to rely on the transmission of each other's writings with a minimum of distortion.

It is refreshing to read in scattered passages—and particularly in the futuristic final section—a recognition that in geography, as in many other fields, there are not only difficulties but perhaps ultimate limits to the application of a model of scientific approach taken from the field of physics. Unfortunately, Chisholm's study appears to be based on the common misconception in scientism that only one scientific method exists and that where it is not applicable, science has no principles or guidelines to offer. The problem, however new to any one generation, is not new to the field of geography; perhaps reconsideration of our heritage will turn up concepts and principles of scientific thought discarded in the revolution but now seen to be needed.

In a different respect, Chisholm would have us restore to major importance the time-honored topic of man's relationship to his natural environment. Geographers would be well advised to consider the critical discussions of the meaning and consequences of that topic which were written before 1950. Surely we learned then that all the fields of science concerned with man, including human geography, must be concerned with man's relationship to his environment, to all of it. To add the limiting word "natural" does not distinguish an actual sector of the total environment, not one that other fields will recognize as peculiarly geographical. Neither does the restriction assist the geographer in studying any actual problem.

If it be true that in response to these criticisms there developed a negative reaction even to the word "environment," let us by all means recover and reassert our concern for the environment we live in—the environment literally as all that is around us of whatever origin. In the tradition of Humboldt, we are impressed by the two great contrasts of this earth as the home of man: on the one hand the amazing similarity of humankind all over it, in genetic needs and capabilities as groups, and on the other the extraordinary range and variety of the different environments we inhabit and the consequences of those differences.—RICHARD HARTSHORNE

SPACE LOCATION + REGIONAL DEVELOPMENT. Edited by M. CHATTERJI. 239 pp.; maps, diagrs. Pion Limited, London, 1976. Distributed by Academic Press, London and New York. \$13.75 (paperbound). 9 x 6 inches.

This volume is a collection of papers that were originally presented at a symposium on regional science held at the State University of New York at Binghamton in 1974. They have been published by Pion in the same format as the well-known *London Papers in Regional Science*. If the conference had been held only a few years earlier, the contents of such a volume would have been fairly easy to predict: papers on regional and urban development problems treated primarily from an economic point of view but with the mixture of analytical rigor and concern for planning applications which has characterized much of the work in regional science. In the 1970's, however, regional science, in common with geography, has experienced a widening of topical interest and some recognition that traditional economic viewpoints are not sufficient to encompass the range of urban and regional problems. This volume reflects the widening of interest and carries it to the point of eclecticism. Some of the articles are on topics remote from the usual interests of geographers, such as the time behavior of welfare recipients and decision making for municipal expenditures.

Traditional concerns of regional science are represented in the volume. Chatterji provides a useful review of the field, in which he enumerates the major problems that have occupied regional scientists and discusses the application of traditional methods such as interaction models, input-output analysis, and regional econometric models. Chinitz presents an extensive

empirical analysis of metropolitan growth patterns in the United States and shows that the problems of central cities are not confined to the large metropolitan areas. The central cities of small metropolitan areas are apparently experiencing the same difficulties. An extension to the theoretical literature on urban rent models is provided by Schuler, who shows how the spatial equilibrium distribution of residential population responds to variations in household tastes as well as differences in income distributions.

Two papers are concerned with topics in urban transportation analysis. Boyce, Allen, and Tang present a method for estimating the impact of rapid transit lines on the sales prices of residential property. The method uses a simple model of market areas to identify regions where rapid transit lines have an impact on property values. Empirical results for the impact of the Lindenwold line near Philadelphia are presented. The economics of car pools are subjected to an extended analysis by Newlon, who discusses possible benefits to users as well as the positive effects on energy consumption and congestion.

Another set of papers deals with issues of pollution control and environmental management in several contexts. Isard and Kaniss analyze the problem of worldwide environmental management in the framework of a recursive linear programming model of world production. Outputs of pollution are included among the activity levels determined in this model, and management policies can be expressed as constraints. Isard and Kaniss use the model to point out the sources of major international conflicts that are likely to arise in the context of environmental management and argue for a strong world organization to cope with these conflicts.

Environmental pollution at the scale of an urban center is analyzed by Cesario. He presents some of the results of an extensive analysis of relationships between urban structure and air pollution, including the relationships between pollution and urban size, the age of a city, the use of pollution-control technology, and the spatial form of the city. Environmental quality in the context of wilderness management is discussed in an article by Smith, Webster, and Heck, who report on the use of a simulation model to evaluate the effects of different management strategies.

The remaining papers range over a variety of topics, and some present innovative research. Charnetski offers an approach to multiple-criteria decision making that can accommodate subjective evaluations, and he applies it to an airport site-selection problem. A paper by Hsu discusses the possibilities of using aerial imagery to obtain data useful in urban analysis. Bahl and Graytak present a model that estimates the effect of changes in metropolitan employment on property tax revenues. Jones and Clark analyze the effect of regional variations in entrepreneurial attitudes on differences in regional development.

Conferences of the kind that led to this volume are extremely useful, and publication of the papers is generally a worthwhile, but not essential, part of the whole activity. These papers lack a unifying theme, but that is a consequence of the way this particular conference was organized. I had hoped to find at least one paper with such broad appeal, or of such outstanding quality, that it might be recommended to a general audience. No such paper is included in this volume; and prospective readers will find, at most, only a few articles that are relevant to their own special research interests.—JOHN ODLAND

THE EXPERIENCE OF LANDSCAPE. By JAY APPLETON. xiii and 293 pp.; maps, diagrs., ills., bibliogr., index. John Wiley & Sons, London, New York, and elsewhere, 1975. \$26.00. 9 1/4 x 6 inches.

Jay Appleton sets out to answer the questions, What is it that we like about landscape, and why do we like it? He first defines the questions and examines what a few other students of the subject have said, concentrating particularly on the eighteenth-century theoreticians (Edmund Burke, Uvedale Price, and Archibald Alison) and landscape architects (William Kent, Lancelot Brown, and Humphry Repton). The cornerstone to his argument, however, is laid by John Dewey. "To grasp the sources of the esthetic experience," wrote Dewey, "it is . . . necessary to have recourse to animal life below the human scale." The line of argument is ethological; our

aesthetic sensibility is the result of behavior characteristics for survival. Applied specifically to landscape appreciation, the argument leads to what Appleton calls the "habitat theory": "Human beings are born with a tendency to be immediately and spontaneously aware of their physical environment. . . . They experience pleasure and satisfaction from such an environment when it seems to be conducive to the realization of their biological needs and a sense of anxiety and dissatisfaction when it does not." Appleton may provide one reason for enjoyment of a landscape of rich fields of grain, but his postulate seems contradicted by frequent derivation of equal aesthetic pleasure from inhospitable mountain or desert landscapes.

Skipping over the problem of beauty in stark landscapes, Appleton introduces a special corollary to his habitat theory, which he calls the "prospect-refuge theory": "Because the ability to see without being seen is an intermediate step in the satisfaction of many [biological] needs, the capacity of the environment to ensure the achievement of *this* becomes a more immediate source of aesthetic satisfaction." In other words, we appraise environments strategically by asking who or what in the environment could harm us (hazard), whether there are points whence we would have a good view of possible approaching harm (prospect), and where in the landscape we could hide (refuge). Appleton goes on to analyze a number of landscapes, landscape paintings, and landscapes described in poetry in terms of the "balance" in each of symbolic hazards, prospects, and refuges.

This prospect-refuge theory is neat and simple, and it will undoubtedly often spring to mind when I contemplate landscapes in the future. Unfortunately, however, Appleton tries to push the theory too far. One problem which recurs throughout the book is that of the interpretation of symbols. Objects do not always symbolize the same thing to each observer, and everyone may not agree with Appleton's assignment of any particular landscape feature to the hazard, the prospect, or the refuge category. Appleton interprets a cave seen in a landscape, for instance, as a refuge, but to me a cave is a hazard. I fear the unknown lurking within. An expanse of water is a prospect, but not to a nonswimmer. Appleton feels security (refuge) amid a tightly enclosing forest; I feel uncomfortably claustrophobic. I think most of us associate dark with gloom rather than with safety. If I am right, Appleton's ideas on modern abstract art suffer. "If we can go no further than equating areas of bright, light colours with the concept of 'prospect,' and dark, subdued colours with that of 'refuge,'" he writes, "we have begun to inject into an abstract composition an element of 'meaning' in habitat-theory terms." New York's Museum of Modern Art considers such theorizing unfair to the artist and has strictures on the reproduction of paintings from its collection exactly in order to forestall it.

Another serious problem with this book is Appleton's free movement back and forth between discussion of landscapes and discussion of landscape paintings. He consistently uses landscape paintings to illustrate points of landscape analysis. Several times he refers to landscape paintings as "recording" landscapes, but in fact almost all landscape paintings are imaginative creations of the artist, or at least significant rearrangements of real landscape views. Appleton thus underestimates the essential difference between a landscape, which is a three-dimensional unframed view, and a landscape painting, which is two-dimensional and framed. A picture frame is not a window, and our "willing suspension of disbelief" to accept it as a window is only partial. In fact, a great part of our enjoyment of a landscape painting is our appreciation of it as a two-dimensional geometric pattern. Even a photographer frames and thus creates a landscape composition; therein lies artistry.

Appleton's analysis of poetry similarly underestimates the artist's contribution. Do we like a poem because we feel we would like the landscape described to our mind's eye? Only partly. After reading this book we might be more willing to keep that criterion more consciously in mind, but I think the "poetry" in a poem is in its meter, in its rhythm, and in its skill in charging words with meaning.

Artists do not record reality; they create a reality. Appleton's whole aesthetic argument is conservative, if not reactionary. One thinks of the old arguments about the "morality" of art, about whether it should be "useful" or "good," and about the "aesthetes" versus the "Philis-

tines." Wrap the Philistine argument in ethology and you argue that landscape must be "good" and "useful" to be aesthetically pleasing! As long as I see beauty in a desert, however, habitat theory must be seriously deficient, and I must be a hopeless aesthete.

Appleton does not deny that geometry is another way to analyze landscape art. He even notes that sexual symbolism is yet another way. Color balance is a fourth—one to which Appleton should know landscape architects pay particular attention. Significance is still one more; a church steeple, for instance, captures our eye across fields. Appleton's purpose, of course, is only to suggest that we consider landscapes as environments, and, except for the problem of the aesthetics of bleakness mentioned earlier, he does this well. His aesthetic arguments, however, are often naïve.

Several of Appleton's ideas do seem widely applicable and useful. His analysis of the "genius" of specific places long thought beautiful is interesting, and it may help us understand why certain sites attract tourists. His ideas of strategic appraisal of landscape agree with the work of Edward Hall, Robert Sommer, and others who have noted defense as an important element of proxemics. Oscar Newman has argued for "defensible space" in urban housing. Sensibility to threats in the landscape, referred to as "atavistic" by Appleton, may be increasingly necessary in today's violent urban environments!

Because so much of Appleton's argument relies on analysis of landscape paintings, quite a number are reproduced in the book. The quality of these reproductions, however, is so poor that many are illegible. This is inexcusable in a thin, twenty-six dollar book.—EDWARD F. BERGMAN

GEOGRAPHY AND INEQUALITY. By B. E. COATES, R. J. JOHNSTON, and P. L. KNOX. 292 pp.; maps, diagrs., bibliogr., index. Oxford University Press, Oxford, London, and elsewhere, 1977. \$15.00 (clothbound); \$5.00 (paperbound). 8½ x 6½ inches.

The word "inequality" is emotive, to say the least. To those on the left of the political spectrum, inequality is an evil that denies opportunity—in its broadest sense—to the majority of the world's population. To those on the right, inequality is the winder of the springs of incentive that power the capitalist system. For the majority in the political center in the United States a modicum of inequality is acceptable; leveling raises the ominous risk of equality with those of lesser status. Coates, Johnston, and Knox explicitly recognize the perceptual differences attached to inequality, and they establish their position early: inequality is bad. Numerous examples document gross inequalities at all geographical scales, and the student who reads reasonably carefully will probably be shocked at the pervasiveness and ramifications of inequalities in housing, education, nutrition, health care, and other phenomena.

The early chapters incorporate approaches that have been developed in the literature on social indicators. Particular emphasis is placed on the works of David M. Smith, including his advocacy of using the concepts of welfare economics in a spatial context. The authors' concern focuses on "objective" indicators, because "soft" indicators of social well-being—measures of satisfaction rather than of some reality such as housing quality—have received few geographical applications. The dilemma of weighting social indicators is given some attention, and several options, each with serious drawbacks, are discussed. What is identified as a "pragmatic and commonly-used" approach, to weight indirectly through the selection of variables, implies that weighting indicators may be so problematical as to be essentially a lost cause. In general, the social indicator analyses reviewed are diverse and appropriate for the illustration of the inequality theme. The authors draw on various examples, including the United Kingdom, the United States, India, France, and other areas. Admittedly, measurement techniques are crude and "probably underestimate the true intensity of spatial inequalities."

Two chapters emphasize economic inequalities at the international, regional, and urban scales. Living costs and inequalities in real income occupy the bulk of one chapter. In a section on crime, dealt with in a chapter entitled "Location and Livelihood," emphasis is on the etiological roles of city size, cultural factors, and the physical environment. A broader view

would have been appropriate here, with some mention of spatial inequalities in law enforcement, justice, and corrections. Geographical variations in capital punishment in the United States, for example, could have provided dramatic evidence of raw spatial inequality. However, the British-based authors live with a criminal justice system less prone to bizarre inequalities than its United States counterpart, a circumstance that may have influenced their interpretation of the crime issue.

A chapter on "Legally Bounded Spaces and Inequalities" offers useful insights into the political manipulation of space in order to preserve or consolidate power. Zoning provides a particularly good example of the application of politics to the maintenance of spatial inequalities.

"Positive discrimination," or the redistribution of resources to disadvantaged areas, is a theme of the concluding section. International aid and regional approaches to positive discrimination are considered, as are approaches to the reduction of inequality through "spatial engineering," or the alteration of patterns of accessibility.

The authors admit the inadequacy of purely spatial solutions in the quest for the elimination of inequalities. Their admission is presumably redundant for most graduate students, but for many undergraduates it may add credibility. The discussion of the limitations of solely geographical explanations provides a point of departure for a relatively polemical conclusion to the book. Although the authors point to the structure of societies as the cause of inequalities, their conclusion leaves the reader wondering just what social structure, if any, they are advocating. The usual arguments against capitalism and its welfare crutch are presented, but the authors also recognize that inequalities are probably pervasive "in the so-called 'socialist' societies of the present time." The implication is that spatial inequalities would cease if some pure form of socialism were to be operative. This vagueness detracts from an otherwise tightly written and well-organized volume.

For what courses or levels of student is the book appropriate? Answers depend very much on the nature of each institution, including the motivation of students with respect to social problems. From my perspective, upper-division courses in social geography or related topics could use the book to advantage, and it could also be helpful in various graduate seminars. It is a rich bibliographical resource and will be useful to graduate students as a source of provocative ideas.—KEITH D. HARRIES

CHINA'S ENERGY: Achievements, Problems, Prospects. By VACLAV SMIL. xxi and 247 pp.; maps, diagrs., index. Praeger Publishers, New York, 1976. \$19.50. 9 1/4 x 6 1/4 inches.

China has made remarkable progress in developing its national economy in the twenty-six years since the founding of the People's Republic. Where does this country with a quarter of the world's population get the energy resources to serve as the basis of economic growth? Vaclav Smil has carefully sifted through information from various sources to provide a good general picture of China's energy problems and prospects. Although most of the official data on reserves, production, and consumption are vague and often dubious, Smil, drawing on the diverse literature, attempts to present a careful appraisal of the growth, current trends, and future course of China's energy.

This study of China's energy is probably the most comprehensive available. Carefully constructed and pointedly written, it is a superior piece of work. The first chapter contains a brief discussion of the "absence of reliable primary information" on the subject. Because of the tremendous psychological and political pressures that operate in China, major problems surround the public issuance, quality, and use of statistical data on energy resources, production, and consumption. As Smil points out, "accurate restitution" of consumption statistics by region, by energy source, or by economic sector is difficult.

Chapters 2, 3, and 4 deal with fossil fuels, hydroenergy, and traditional as well as unconventional sources of energy such as animal and human energy and solar, geothermal, and nuclear power. China's energy trade, the role of energy in the society, and international

comparisons of energy, technology, production, use, and consumption are considered in Chapters 5, 6, and 7. The last chapter gives a closely reasoned synopsis of China's energy situation under the heading "Forecasting the Future." Appendixes include a short list of readings, data on population and economic indicators, and maps of administrative and economic regions.

Self-reliance is the key to understanding the Chinese strategy for energy development. Self-reliant development in China takes place by "walking on two legs": the "leg" of modern technology and the "leg" of traditional technology. For example, along with large modern coal mines exist small and medium coalpits in individual communes worked with labor-intensive indigenous techniques. An estimated three-quarters of the total coal output is produced by modern mines, but decentralized production by local small mines is increasing in importance. The policy articulated since the Cultural Revolution has called for the full exploitation of deposits throughout the country, mainly to widen the geographical base of industrialization and to reduce the long hauls of coal from the north to the south. Because of an emphasis on the development of small and medium-sized mines in the provinces south of the Yangtze River, that region is now close to self-sufficiency in coal output.

Amid political turmoil, natural disasters, and apparently widespread apathy among the workers, the Chinese economy in 1976 turned in its worst performance in nearly a decade. The Tangshan earthquake effectively curtailed coal production at K'ai-luan, the largest coal complex. K'ai-luan is the country's principal coking coal source for steel plants in Peking, Tientsin, and Shanghai, as well as in Tangshan. Despite the damage to K'ai-luan, nationwide coal production rose in 1976 as other mines accelerated efforts to bolster production.

Smil traces the rapid growth of the petroleum industry in China with the development of the Ta-ch'ing, Sheng-li, Takang, and Yü-men oil fields. The Ta-ch'ing oil field is a good example of high-speed energy development. Ta-ch'ing, a marshy wasteland sixteen years ago, is now crisscrossed by settlements around oil wells and oil-refining installations. Large-scale production at Ta-ch'ing began in 1963, and it now accounts for a large share of China's total production. Since 1965 China has been essentially self-sufficient in crude oil. In 1976 a slowdown was noticeable in the growth rate of the petroleum industry, which had been achieving annual gains in excess of 20 percent during the past decade. The most likely explanation for the slowdown of the Chinese oil boom is a combination of natural and political factors, both domestic and international. The "Gang of Four" is widely believed to have successfully diverted state resources away from petroleum development when the Tangshan earthquake necessitated assistance to the badly hit coal industry. At the same time China found that demand for its oil exports slackened, a circumstance that further depressed oil exploitation.

Smil notes China's abundant waterpower resources and the obstacles to their development. Despite impressive achievements in development, more than 95 percent of the country's waterpower potential is undeveloped. Smil estimates that traditional sources of energy, such as draft animals and human muscles, contributed power equivalent to some 160 million hard-coal tons. The dominant role of traditional sources is illustrated by the fact that "without them the country would have had to increase its fossil-fuel and primary electricity consumption by about 60 percent . . . a task requiring an enormous amount of capital investment and advanced technology." Of the unconventional sources of energy, the atomic power plants may not make a significant contribution to China's power supply before the end of the century.

This book will delight the reader who is interested in learning about China's energy. The author knows his subject well, collects the many strands that are part of China's present energy picture, and weaves them into a creditable whole. But what about future energy policies in the People's Republic of China? What factors on the domestic scene will influence the supply of and demand for energy? What are the implications of these patterns for China's entry into world energy markets? Clearly there are too many unknowns to permit firm predictions. The past and present patterns of energy supply and consumption suggest that for the next decade, at least, geographically dispersed, small-scale enterprises requiring relatively limited amounts of energy that can be supplied from local power plants of low capacity will continue to

supplement the modern industrial sector, supplied with power by larger, technologically more advanced plants.

Given its commitment to self-reliance, China is unlikely to become a major energy importer. Because the modern sector of China's energy industries does not have the necessary production capacity in excess of domestic needs, it is also unlikely that the nation will become a major exporter in the near future. Exports of coal and petroleum will probably be limited to sales in exchange for imported items that China currently lacks the technology to produce, or to pay for purchases of capital goods and new technology, such as offshore drilling equipment. It is evident that self-reliance and "walking on two legs" will continue to remain China's long-term development strategy in the energy field. In this book, Smil has provided an important springboard to probe more deeply into an elusive topic, the geography of China's energy resources.—P. P. KARAN

TRAMWAYS AND TROLLEYS: The Rise of Urban Mass Transport in Europe. By JOHN P. MCKAY. xvi and 266 pp.; ill., maps, bibliogr., index. Princeton University Press, Princeton, New Jersey, 1976. \$14.50. 8¾ x 5¾ inches.

The title "Tramways and Trolleys" evokes visions of page after page of glossy photographs, plus all you ever wanted to know but would probably never ask about the mechanical details of these vehicles. Happily, John P. McKay, a professor of history at the University of Illinois, has written a very different type of book. His goal is to investigate "the growth of the European electric tramway industry between roughly 1890 and 1910, with primary focus on France, Germany, and Great Britain." A comparative study with a regional focus, the work is largely developed around a problematic theme that attempts to analyze and evaluate the rise of urban mass transport.

First, McKay is concerned with the development and diffusion of the electric streetcar and its various technical innovations. Its immediate predecessor, the tramway, a horsecar that was pulled along rails laid in city streets, was introduced in Paris in 1853 and in England in 1859. Experiments proved that steam and battery power were technically, aesthetically, or economically unacceptable as replacements for the horse. The major challenge of electricity was a suitable method supplying current to the motor of a moving vehicle. Although some technical innovations were European, notably German, the electric streetcar or trolley was largely an American development. The first successful trolley system began operation in Richmond, Virginia, in 1888, and the innovation was rapidly adopted elsewhere in the United States.

The development of electric streetcar systems in Europe was more complex than in the United States. McKay describes at some length the patterns of entrepreneurship in France and Great Britain, the former a result of private initiative and the latter a result of municipal action. Not only was public control a major developmental factor in Europe, but important aesthetic concerns resulted in various attempts to avoid or at least modify the visual impact of poles and overhead wires. The overhead power source prevailed because there was no better technical or economic alternative.

One of the most interesting topics that McKay discusses is the impact of the new mode of urban transportation on society. He asserts that the change from animate to inanimate power with the trolley was so significant, both in itself and in its ramifications, that it deserves to be termed a revolution. The statistics show that between 1890 and 1910 the per capita use of public transit in Great Britain and Germany increased by about 400 percent. The increase was achieved largely by lower fares that were the result of continuing efficiencies in the use of electric power and of expansion of service, especially in working-class neighborhoods. In addition, case studies of Brussels and Manchester illustrate the influence of electric tramways on urban form by promoting decentralization of residential areas and concentration of commercial activity. Trolleys also resulted in suburban expansion, special services for holiday and Sunday excursions, and improved working conditions for the tramway employees. The capstone in the argument for a revolution in urban transportation is that the change from "the age

of walking cities and horse-drawn vehicles, including tramways, to inanimate, mechanized, mass-produced, and mass-oriented urban public transportation has occurred only once." In Europe that change took place between 1890 and 1910 with the trolley. Some subsequent additions or changes have occurred with buses, subways, and private automobiles, but they have not been revolutionary.

Although this is basically a historical study, the insights are of value to anyone concerned with the development, regulation, and condition of urban transportation. The bibliography and its accompanying commentary should be helpful to other researchers on similar topics. The deficiency of maps in the book is aggravating, however: there are only two, and one is unreadable.—H. GARDINER BARNUM

MIGRATION IN POST-WAR EUROPE: Geographical Essays. Edited by JOHN SALT and HUGH CLOUT. 228 pp.; maps, diagrs., bibliogr., index. Oxford University Press, London and New York, 1976. \$12.50. 9½ x 6¼ inches.

Migration appears to be a nearly constant factor in the human drama. Humankind has a transient quality that would seem to be a proper subject for investigation by sociobiologists; and adaptability to a wider range of environments than almost any other organism has certainly played a role in allowing man to dominate—for better or for worse—the planet. The universality of the migratory fact probably accounts also for the reasonably simple structure of most theory on the subject. The ideas of Ravenstein, Petersen, Lee, and the others are uncomplicated and logical; and since most of us are practicing migrants, we perhaps feel their truth beyond merely understanding them.

Europe has always played a major role in the drama of human movement. The successive waves of migrant nomads from the East, the forced displacements of threatened groups, and the *Völkerwanderung* of various cultures have been the raw materials on which migration theory (to say nothing of a considerable body of social and cultural geographical thought) have been founded. The overriding event, of course, was the mass movement of Europeans to North America in the hundred years before 1930, a reality that affected a great number of us and/or our immediate ancestors and that served to condition our views on not only our European roots but also the nature of the migratory process itself.

Against this background, it should come as no surprise to learn that Europe is still the migratory continent par excellence, that migratory streams are homogenizing the population of that culturally fragmented region to a considerable degree, and that dealing in some way with migrant populations is a primary concern of most European governments. Surprisingly, however, nothing resembling a geographical overview of recent trends in European migration has been published. This gap reflects the facts that the decision to migrate is an intensely personal one, that numerous migratory acts thus escape any formal accounting, and that migration, more elusive than birthrates and other demographic data, often exhibits patterns of change that go unnoticed until their impact becomes apparent.

The principal and considerable virtue of the present volume is that it pulls together information on recent European migration and presents it in a logical and useful structure that reveals both the unsuspected dimensions of the phenomenon and the gaps in the picture where data and interpretation remain to be provided. The principal themes are, of course, the universal drift of rural populations to urban economic and cultural opportunities, the suburbanization of larger metropolitan centers, and the substantial movement of labor migrants—mainly from the Mediterranean borderlands to the northwest—that have, together, changed the European scene almost beyond recognition since 1950.

"Migration in Post-War Europe" is organized around these themes. An introductory section on the demographic background of Europe is followed by chapters on rural-urban flows, interregional migration, and international labor migration from the standpoint of both supply and demand regions. A final chapter deals specifically with migratory patterns in

Eastern Europe, where government controls and decisions modify, without greatly lessening, migratory currents.

Migration is a highly contemporary phenomenon if nothing else, and the authors have added a postscript in a valiant effort to update the subject of 1976, although such an attempt is doomed to frustration. Within a period of only a few months, for example, the concern of France, West Germany, Switzerland, and other importers of migrant labor shifted from assuring steady supplies of manpower to the minimum human and economic rights of the migrants to methods for sending a large share of them home. Even a minimal lag in publishing precludes success in following all of the convolutions of the subject.

For a work that combines contributions by several authors, this volume has a considerable degree of cohesiveness, a credit to the editorial skill, one suspects, of Hugh Clout, who has produced several recent collections with remarkably even style. The bibliographies are detailed and useful, and data are generally the latest and best available up to 1974.

Almost all of the book's shortcomings, on the other hand, stem from the noncomparability of data and the unevenness of national efforts in the assessment and control of migration. Maps abound in the text. Although they are technically well done, they often fail to convey much information and are not comparable from chapter to chapter. Flow diagrams of labor migrants to France and West Germany are effective, but those that show movements of small numbers of people to Great Britain or to the Netherlands are essentially wasted space. In contrast, the maps of internal migration among the political divisions of the Eastern European states are excessively cluttered and complex; tabular data would have been preferable. The book is also somewhat weak in discussing the evolution of migration policy in various countries and in assessing the role of the European Community and other international agencies. It also tends to become tedious in places, with sterile numerical discussions of net migratory trends in one state or region after another.

These shortcomings aside, the volume is remarkably successful in presenting contemporary data on European migration and in synthesizing on the part of the authors. It is recommended to all students of population geography, of cultural and economic impacts of migration, and of the modern European scene.—JAMES R. McDONALD

THE U.S.S.R. By JOHN C. DEWDNEY. xv and 262 pp.; maps, diagrs., bibliogr., index. Westview Press, Boulder, Colorado, 1976. \$19.50. 8½ x 5½ inches.

Dewdney's latest volume, part of the Westview Special Studies in Industrial Geography, is written in the same factual style as his textbook, "A Geography of the Soviet Union" (Pergamon Press, Oxford, 1965 and 1971), but the more extensive and exclusive treatment of industrial geography removes "The U.S.S.R." from the textbook category, although it could be used in the classroom by serious students at all levels.

For those who seek a readable, generally interesting, and highly accurate description of Soviet industry, with a good treatment of its resource base and its historical background, this book is strongly recommended. On the other hand, anyone who desires an analytical account will be disappointed. Relatively little attention is given to locational decision-making procedures, the role of Marxist ideology, socialist locational planning principles, or economic regionalization as a factor in industrial planning and development. True, these matters have been examined by other Western observers, but Dewdney's scant treatment reduces the opportunity for analytical discussion and tends to put his book in the reference-volume category.

The author is at his best when he is discussing a particular industry or an industrial region, is describing its historical development, is noting the locations of fuel and material sources, or is pointing out the changing importance of some activity and the reasons behind the change. He provides useful and current information on production, capacity, and a host of other related items. Indeed, the book provides a wealth of valuable information for researchers and teachers.

Furthermore, it is very much to the author's credit that he presents the material in such a clear and impartial manner.

Dewdney has obviously done a thorough job of combing the appropriate English-language sources of recent information on Soviet industrial geography. As he acknowledges, extensive use has been made of material in *Soviet Geography: Review and Translation*, especially the "News Notes" section by Theodore Shabad. Data from such basic Soviet sources as statistical handbooks and atlases are also frequently used. The fact that much of the information is from secondary sources should not be interpreted as a criticism or as implying any lack of accuracy. Indeed, I spot-checked a fair number of the factual and statistical statements and found them to be highly accurate and as up-to-date as one could reasonably expect for a work published in late 1976.

The book is divided into three sections. Part One, entitled "Factors in the Development of Soviet Industry," provides introductory and background material (environmental and resource base, demographic trends, transportation, and historical summary). Part Two, "Major Sectors of Soviet Industry," examines the Soviet economy topically (fuel and power, metallurgical and engineering industries, chemical industries, and timber/light/food industries). This is the strongest part of the book; the descriptions are all highly informative with the exception of the food industry, which is given short shrift. Part Three discusses "Regional Contrasts in Soviet Industry." It uses an interesting threefold breakdown: European Core, Regions of Recent Growth, and Less Developed Regions. Thus Dewdney treats regionally some of the material already examined topically in Part Two. I have never understood why so many geographers writing on the Soviet Union feel obliged to provide a duplicative topical-regional treatment of material, particularly that of an economic nature, for a country where centralized planning and control so clearly suggest a topical approach to analysis.

A disappointing chapter on regionalization precedes the regional examination of industry. At first scanning, the reader is encouraged by a useful series of maps that show political-administrative divisions, major economic regions (past and present), Khrushchev's Sovnarkhoz and industrial management regions, and regionalization systems proposed by David Hooson in 1966 and by Dewdney in this book. Unfortunately, the accompanying text is largely historical-descriptive, with only brief mention given to the deep ideological and theoretical bases for regionalization in the Soviet Union, the great importance attached to it, and some of the more enduring schools of thought on the subject. For example, the concept of the territorial production complex, whatever one's opinion of it, deserves more than a fleeting reference if only because of the immense attention given to it in Soviet planning and academic geographical circles.

In summary, Dewdney's book is well written, fascinating to browse, and heavily factual, and it offers a current and accurate account of Soviet industry. Unfortunately, a book heavy on up-to-date facts but light on analysis quickly becomes out-of-date.—RICHARD E. LONSDALE

ST PETERSBURG: Industrialization and Change. By JAMES H. BATER. xxiii and 469 pp.; maps, diagrs., ills., index. McGill-Queen's University Press, Montreal, 1976. \$32.00. 9 1/4 x 6 inches.

Little has been published on the historical geography of Russia—Tsarist or Soviet. Geographers in the Soviet Union are preoccupied with utilitarian economic and physical geography and look to the future, not to the past, as befits a revolutionary regime with a centrally planned economy and a materialistic mission. Historians have taken up the slack, but with limited enthusiasm and imagination (with the notable exception of Gumilyov). Western historical geographers have been equally neglectful, despite the recent upsurge of their subfield. So it is heartening to receive BATER's book, especially because it applies both lucid description and rigorous analysis to the underappreciated urban-industrial scene.

BATER's purpose is to examine the impact of industrialization on St. Petersburg, Russia's imperial capital, largest city, main industrial center, chief port, and gateway for foreign

influences. The themes are process, pattern, and structure; and the approach is the testing of locational hypotheses in the late 1860's and in the early 1910's, when the economy was expanding and for which statistical and cartographic data are ample. The themes are thoroughly explored (with the possible exception of ever-elusive process), and the hypotheses are tested carefully. The result is an excellent book—with an exorbitant price tag.

The study suffers from only three shortcomings, the most serious of which is the neglect of archival sources, notably those of Leningrad itself, particularly the Leningrad State Historical Archive. The author may well have been denied access to Soviet archives (he intimates as much); if so, he was unfairly prevented from supplementing and/or complementing the information he garnered in published sources. Less serious is the tendency for the great amount of detail to obscure the general pattern; a summary at the end of each chapter would have helped the reader to see the forest as well as the trees. Lastly, St. Petersburg's industrial development is not put sufficiently into the national context, so that it is difficult to know whether or not the situation in the capital was typical of the situation throughout Russia. These criticisms notwithstanding, the book is a solid and welcome contribution to our understanding of Russia's geographical past.

Chapter 1 describes St. Petersburg's position and sets forth the questions to which subsequent chapters are addressed. Chapter 2 sketches the planned development of the capital, from its forced beginnings in 1703 as a political and military foothold on the Baltic, through its rapid and spontaneous growth during the reign of Catherine the Great (under the direction of foreign architects), to its utilitarian transformation by merchants in the middle of the nineteenth century. Commercialization and industrialization, stimulated largely by imperial decrees, brought merchants, craftsmen, and laborers from elsewhere in Russia and abroad, and quickly made Peter's city a major center of shipbuilding and armaments manufacture—symbolized by the Admiralty and the Arsenal—and a leading port and commercial focus—symbolized by the Commodity Exchange and the Trading Rows. The former functions reflected the exigencies of frequent wars; the latter, the city's gateway role and barren hinterland. By the mid-1800's factory production was dominated by cotton manufacturing to satisfy the enormous demand in rural Russia for an inexpensive fabric and by metalworking to meet the needs of the emerging railway network. Industry was spurred by an influx of furloughed serfs, who were permitted by their seigneurs to render their quitrent in cash earned in the city's enterprises rather than in less reliable cash or kind derived from agriculture. The population of St. Petersburg grew from 40,000 in 1725 to almost 100,000 in 1750, to almost 250,000 in 1800, and to almost 500,000 by 1850.

The study begins in earnest in the late 1860's. By then machine production had largely replaced hand manufacture, and emancipation had released millions of serfs for the cities. The grand and orderly townscape, with its extensive network of rivers and canals embanked in granite, broad avenues, large architectural set pieces, elegant palaces, sumptuous theaters, resplendent churches, and lavish museums, was being marred by dirty factories and squalid tenements as the city changed from a glittering court-administrative center to a morbid industrial-commercial complex. The transformation is framed in two period pictures (Chapters 3 through 6), each of which focuses on urban economy and urban morphology. Industrial expansion was promoted by wars, emancipation of serfs, increased railroad construction, tariff adjustments, modernization of financial institutions, and a resurgence of foreign investment. Growth was particularly intense after 1890. By 1913 St. Petersburg accounted for nearly a tenth of Russia's industrial output and employment; the city contained almost a thousand factories (a quarter of which, especially the largest ones, were foreign owned and many of which performed break-of-bulk functions). As industrial production grew in scale, metalworking came to dominate industrial employment. The 1913 total population of more than 2 million had tripled since 1869, and the industrial labor force of almost 250,000 had sextupled. Emancipated serfs flocked to the city for wages to meet the redemption payments for their land allotments; the peasants' share of the city's population rose from less than one-third in 1869 to almost three-fourths in 1913. Wages were low, hours were long, child labor was common, and housing was so

scarce that room corners, cellars, and doss houses became widespread. Congestion and endemic flooding promoted typhus, cholera, and other infectious diseases; deaths exceeded births; and St. Petersburg became known as the least healthy capital in Europe. Conditions were worsened by weak municipal government, inadequate municipal services, corrupt officials and businessmen, and labor unrest.

The final chapter summarizes the interrelationships between industrialization and urbanization and casts them in a wider, comparative framework. Bäter's findings support the notions that factories tend to become larger in scale during industrialization, that the large-scale factory in Russia was simply a substitute for a shortage of managerial and entrepreneurial talent, that during industrialization more and more fossil fuels are imported, and more and more finished or semifinished products and fewer and fewer raw materials are exported, and that there is a marked inverse relationship between distance of travel and number of migrants to an industrializing city, with females tending to move shorter distances than males and with the share of female migrants increasing over time.

On the other hand, several hypotheses are not supported. The tendency toward independence rather than interdependence (and hence the minimal need for external economies) in production resulted in limited evidence of spatial proximity of linked factories and workshops. Deglomerative pressures—manifested in escalating rents and property values—did not cause a massive exodus from the city to the suburbs because the workers had neither the money nor the time to use public transport. Workplace and residence remained closely linked for almost all classes. Also, industrial establishments tended to diversify, not specialize, over time. Industrial location was strongly conditioned not by agglomerative pressures, rental costs, land values, zoning laws, or transport access but, apparently, by labor supply and land-development practices. Finally, the growth of St. Petersburg as a market failed to boost surrounding agriculture, which was weakened rather than intensified by the poverty of the physical environment and was stultified by serfdom.

Most readers of this volume will be left with several general impressions, such as the strength of state and the weakness of private industrial enterprise, the importance of foreign capital and expertise, and the extent and duration of technological and managerial backwardness. But their overriding impression may be that the industrial modernization of St. Petersburg was peculiar or highly relative, in the sense that it was incomplete or halfhearted—a mixture of the old-fashioned and the newfangled, just like the country as a whole. Much backwardness prevailed, as in the quality of consumer goods and the ethics of business transactions, and the city remained basically one of peasants whose seasonal petty trading and day laboring were not enough to commit them fully to city life. Even the landed gentry were seasonal residents, maintaining a social whirl in their apartments and palaces in the winter, when the hot weather was absent and pestilence was dormant, and fleeing to their cool dachas and estates in summer, when many of the city's peasants likewise returned to the countryside for the farming season. The lack of an efficient, inexpensive, and extensive system of public transit in the capital resulted in the retention of the traditional, essentially preindustrial, admixture of social classes and economic activities. Moreover, in tightly structured Russian society it did not matter much where one lived in the city, because social recognition was more personal than spatial. So the industrialization of St. Petersburg—like that of Russia as a whole—meant some change but also much continuity in structure, pattern, and process.—JAMES R. GIBSON

PLACE AND PLACELESSNESS. By E. RELPH. 156 pp.; diagrs., ills., bibliogr., index. Pion Limited, London, 1976. Distributed by Academic Press, London and New York. \$4.50. 9¼ x 6¼ inches.

For a variety of reasons places are in the news these days. We elected a president from a once obscure but now unforgettable place in Georgia. Previously remote places like Oklahoma and Appalachia are experiencing in-migration, and entirely new places are emerging in the energy-

rich areas of the West, from New Mexico to Montana. Throughout 1976 hundreds of small towns scheduled Bicentennial programs to consider how they could become larger towns without experiencing unnecessary growing pains. In larger towns, particularly in the so-called Sunbelt, people were making cruel jokes about places in the North and the East, and they were comparing themselves favorably with folk living in the desirable but overpriced places of the West and Northwest.

Thus a book about places, published in 1976 by a geographer, is both timely and adventurous. Edward Relph rejects two traditionally geographical approaches to the study of place: the detailed description of particular places and the development of spatial models for analyzing systems of places. Instead, Relph chooses the more difficult task of writing about what places really are. In this short book he attempts to delve into "the various ways in which places manifest themselves in our . . . consciousness of the lived world, and with the distinctiveness and essential components of place and placelessness as they are expressed in landscapes." The result is a book that is fascinating, not only for what it actually says but also for what it merely suggests.

Reading "Place and Placelessness" left me in no doubt that the study of place gives geographers a basis for mutual understanding in an otherwise multistranded discipline. More importantly, it provides young geographers with a link to their past. Geographers have taken places with them down new interdisciplinary avenues, and they have made contributions in a number of apparently diverse academic fields. As I read the book I thought about how many of the "new" subfields in geography are still tied to place and was reminded that modern human geography still has an underlying theme. For that reason alone perhaps we should all read Relph's book at least once a year. At first I could sympathize with Relph's bitterness toward the urban and economic geographers who have strayed so far from the humanistic study of place. For them, places are not studied as the "symbolic or functional centres of life for both individuals and communities." But then I asked myself, Why should they be? Perhaps we need to have some geographers interested in a "placeless geography, a flatscape, a meaningless pattern of buildings." According to Relph, placelessness abounds, if that is not a contradiction in terms; so somebody may as well be studying it.

I was more than a little concerned about the different types of placelessness Relph describes in Chapter 6. To start with, I found the traditional condescension toward suburbia a little tedious. Just for once couldn't someone write something nice about suburbs? I picture a rather ludicrous scene in which the professor spends his days writing about "kitsch" and "subtopian" vapidity, while his evenings are spent in the den of his suburban ranch house. I was confused by the distinction between self-consciously and unself-consciously made places. I thought I was following the argument, but the picture of Castle Combe in Wiltshire took me aback because I have always thought of English villages as highly manicured and deliberately maintained places. I was also puzzled by the discussion of placelessness in the section on Disneyfication, Museumization, and Futurization. As Relph notes, shopping centers are simple landscapes and easy to comprehend, but such is not always the case with "substitute" environments. I am thinking of the wonder in a child's eyes at Disneyland and of the portrayal on "60 Minutes" of the thousands of New Yorkers who trip into Bloomingdales to empty their pockets. These are totally contrived places, but why are they so popular? Surely it cannot be because they present a simple, undemanding landscape, as Relph suggests. If anything, it appears to be the utter chaos and sensory bombardment that lures people.

My major concern about "Place and Placelessness," however, is that Relph does not even choose to discuss what we as geographers ought to be doing or thinking about placelessness. We may not be able to fight the business interests that create wonderworlds and shopping centers, but what about the low-point states in Peter Gould's mental maps, the much-maligned American cities, or the hundreds of drab small towns dotted across the Plains? The geographer cannot go out and rebuild, but was there nothing we could have done to complement the work of local Bicentennial committees? Is there nothing we can do now to advise state tourist agencies, local chambers of commerce, and urban renaissance groups? Relph thinks not,

because deliberate attempts to create places or to enhance place consciousness will only reinforce mass stereotypes of a place. What is needed is the development of the "existential" or "authentic" identity of a place. Relph is correct, but he offers no suggestions about how this might be achieved. Some places—Pittsburgh and Liverpool, for example—have worked hard to change their identity, and, arguably, they have been successful. Other places, including Detroit with its new Renaissance Center (Ren Cen), are trying desperately to do the same. But Relph believes that to be successful, humanistic placemaking requires an approach "that is responsive to local structures of meaning and experience, to particular situations and to the variety of levels of meaning of place; an approach that takes its inspiration from the existential significance of place . . . and the ontological principles of dwelling and sparing identified by Heidegger." With such stringent requirements Relph ensures that the possibilities for enhancing the sense of any place are intellectualized out of existence. He has convinced me that geographers should pursue the scholarly and sympathetic study of human settlements, but his book needs sequels to suggest what else geographers could be doing in public service. The urban "vignettes" commissioned by the Association of American Geographers are a step in that direction, but the field is still wide open. Current research and development work in the area of energy demonstrates that a case can be made for doing something, anything, if we think it may work. In many places, both small and large, citizens who are concerned about their sense of place are in a quandary—to grow or not to grow? With most North American cities as models, perhaps they might be advised to avoid excessive development, but what are the alternatives? Enhancing place consciousness involves a subtle combination of physical change and an attempt to generate vitality and awareness among the citizens. As Relph suggests, too much done too quickly becomes obnoxious. The answers are indeed difficult to find, but the alternatives may be too grim to comprehend. As one old-timer told me in Weatherford, Oklahoma, "There's nothing quite so sad as knowing you live in a small stagnating town in Oklahoma . . . except, perhaps, knowing you live in a small stagnating town in Texas!"—CHRISTOPHER J. SMITH

THE LANDS NO ONE KNOWS: America and the Public Domain. By T. H. WATKINS and CHARLES S. WATSON, JR. 256 pp.; ills., index. Sierra Club Books, San Francisco, 1975. \$9.95. 10 1/4 x 7 1/4 inches.

PUBLIC GRAZING LANDS: Use and Misuse by Industry and Government. By WILLIAM VOIGT, JR. xiv and 359 pp.; maps, ills., index. Rutgers University Press, New Brunswick, New Jersey, 1976. \$19.95. 9 x 6 inches.

Western ranchers whose livestock graze on unreserved federal public domain lands have long been concerned and involved with management of the land by the federal government; but even as recently as twenty-five years ago, almost no one else was. Although general interest in the public domain lands has been slowly, persistently widening and intensifying throughout the last quarter of a century, the knowledgeable public is still pitifully small, its information vague and uncertain, its concern hesitant and confused.

The objective of the authors of "The Lands No One Knows" is to broaden and deepen general understanding of public domain lands and of their management by the Bureau of Land Management, an agency of the Department of the Interior. It is intended as a popular book and is written in striking, colorful, and journalistic language and style by Watkins, a professional writer, from data supplied chiefly by Watson. The latter is an unusual person who early developed a consuming and overriding interest in the public domain, has tirelessly studied, explored, and enjoyed it throughout his adult life, and has energetically worked to enlarge public awareness of its qualities and to protect it from any threatened damage.

Watkins and Watson cover the origin and entire history of the public domain lands and summarize their current condition, management, resources, and problems; all in 223 pages, to which are appended 11 pages of "notes" and a 17-page "wilderness index" that presents state-by-state capsule descriptions of the more picturesque and aesthetically attractive locales in the

public domain. Such an ambitious undertaking in so small a space requires a relatively superficial and impressionistic treatment. This treatment neither invalidates nor demeans the book; it clearly is intended for readers who know little or nothing about the public domain lands and presumably have only general interest in them—a clientele unlikely to read an exhaustive, scholarly monograph. Several of the authors' facts, conclusions, and implications are probably debatable, but none of the putative errors detracts significantly from the utility of the book. Surely one may conscientiously wish the authors every success in attracting the readers they seek to reach and to influence.

Although Voigt's "Public Grazing Lands" is also directed toward a general reading public, the book is much more scholarly, its research more serious and professional, and its presentation of evidence more solid and meticulous, striving to follow accepted standards of historical documentation. It is a descriptive and analytical history of the management of grazing on the two major classes of federally owned western rangeland, the national forests and the public domain. Most of Voigt's volume focuses on post-World War II controversies and political maneuvers between the livestock ranchers on the one hand and the U.S. Forest Service and Bureau of Land Management on the other.

Voigt provides a capsule history of the federal lands in his first seven chapters. He covers the gradual development of the landownership patterns in the eleven western states, the formation of the national forests and the Forest Service, and the establishment of the current federal land-grazing arrangements—allocated, partially controlled, private grazing on the public lands in exchange for payment of a grazing fee by the grazer. His discussion of the early disagreement and controversies between the range livestock ranchers and the Forest Service over grazing fees and of the Forest Service decisions about the intensity of grazing permissible on the national forest lands leads to another of Voigt's themes.

Beginning with his account of the controversies between the antagonists in the middle and late 1940's, Voigt adds more detail, analyzes more penetratingly, and reports his own research findings (based on *post facto* interviews with several of the Forest Service officials directly involved in the controversies, and also with some conservationists, then supporters of the Forest Service and whose only criticism of its policy was its failure to assert an even stronger and more extreme position). Voigt chronicles in exhaustive detail the public events, political maneuverings, published statements, and internal bureau memos, all carefully documented. From available evidence he also surmises about the bases for agency decisions, but he always scrupulously identifies his suppositions.

Reduced to essentials, the continuing controversies between the federal administrative agencies and the range livestock ranching interests involved just three issues. The first was the level of federal range grazing fees. As a matter of financial self-interest, the ranchers wanted fees to be kept as low as possible. The federal bureaucrats were largely indifferent to the price of federal range grazing fees; they would directly benefit not a whit if fees were increased. However, a determined coterie of eastern congressmen were convinced that grazing fees were too low, and they used their budgetary power over appropriations to pressure the controlling agencies to raise fees and to punish the agencies if they did not do as directed.

The second item of controversy indirectly involved the same matter of grazing fees. If the fee for a permit to graze the federal range is significantly lower than the cost of alternative sources of livestock foraged, it constitutes a government subsidy to the permittee. If the subsidy and permit are stable, and durable over time, and if the permits can be bought and sold, the annual value of the subsidy attached to the permits can be and are capitalized. The ranchers were and are fully aware of this; hence they do everything they can to strengthen their proprietary interest in their permits—if possible, to make permits irrevocable and unalterable by the government without compensation for changes adverse to their interest. The government agencies have maintained the position that the permits are a privilege, not a right, and may be altered by the government whenever changes are in the public interest.

The proper level of grazing intensity is the third point of disagreement. It is the one major

aspect of the public interest that may demand alterations of ranchers' federal grazing permits. Almost from the moment they were empowered to allocate and license grazing on federal lands, the two federal range management agencies have been asserting that the condition of the vegetation on the ranges was deteriorating because of too great grazing pressure and that the pressure should be reduced by decreasing the number of animal unit months of grazing allowed by the grazing permits. The ranchers have implacably resisted and opposed this view, not so much because of the consequent reduction in numbers of livestock that the permittees could graze on the range but because of the inevitable decrease in the capitalized value of their permits. The ranchers' means of furthering their point of view has been to generate political pressure, largely in the Congress, against the federal range management agencies.

Voigt's most significant contribution is his detailed description and analysis, first, of the efforts of the livestock industry to bring effective political pressures to bear on the range management agencies in support of the ranchers' viewpoints on these three controversial issues and, second, of the agencies' reactions and attempts to escape the pressures. Voigt is especially to be commended for his persistence, ingenuity, and skill in uncovering data and internal testimony concerning the administration of grazing by the Forest Service. That agency has always carefully nurtured and tailored a public image of being an organization of expert, skilled professionals dedicated to the public interest. To promote that image they prefer to present carefully selected evidence of the usefulness and success of management actions on the national forests. If circumstances force them to respond to questions about Forest Service programs, the loyal, disciplined members of the service will respond with the current programmatic line.

One caveat on the book is in order. For approximately a decade, when controversies over the federal grazing lands were at their height, Voigt, as a paid official of the Issac Walton League of America, was an active participant in the political jockeying and in the opposing campaigns to influence public opinion. He was convinced then, as he was when he wrote this book, that his was the right side of the controversy. Phraseology like "an aggressive clique of public land-using stockmen in the West attempted a colossal grab of public domain and National Forest grazing areas, only to be countered by a straggly but determined aggregation of conservationists who didn't admit they were outgunned and fought back" pervades the book. As you read it, do not forget that it is strongly biased, even if you believe that Voigt is "right."—
WESLEY CALEF

THE CITY IN SOUTHERN HISTORY: The Growth of Urban Civilization in the South.

Edited by BLAINE A. BROWNELL and DAVID R. GOLDFIELD. 228 pp.; diagrs., notes, index. Kennikat Press, Port Washington, New York, 1977. \$13.50. 9¼ x 6¼ inches.

Reading this book is sheer and unrewarding drudgery. A bit of roughness presumably is inevitable in any collection of essays written by different authors, but such roughness is magnified when the authors adhere to the rule that one should never use a simple term when a more pretentious one can be found, and it is compounded when the authors have no common sense of purpose. A queasy uncertainty permeates this volume. What, if anything, is distinctive about the cities of the South? How do cities in the South differ from cities in other parts of the nation, if at all? The authors are not sure. Those parts of the book that discuss the South have little to do with cities, and those that discuss cities often are little more than dreary sets of platitudes about institutions that are not distinctively southern. Why should anyone be bothered by such an inability to identify what is urban and southern but not national? The best answer is that this seems to be the task the authors have set for themselves; perhaps their individual essays might better have been published in the appropriate journals rather than in such a collection, because they seem to have little in common but a kind of rough chronological sequence.

The introductory essay by the two editors might be expected to set the tone for the entire volume; instead, it is a confused jumble of bombast. The editors claim that "the role of urban leadership, the relationship of southern cities to the national economy, and the complex

patterns of urban race relations are especially significant" in understanding the urban history of the South. They talk about something called "urban development," but they have not defined what they mean by this term, nor have they managed to communicate to the other authors any clear concept of what falls under the heading of regional urban development.

In the second essay Carville Earle and Ronald Hoffman discuss the failure of colonial authorities to impose an urban form upon pre-Revolutionary settlement. Charleston prospered as a seaport first because of its good connections with the back country and the Indian trade and later as a shipping center for rice and indigo and a reexport center for the Caribbean islands. Small tobacco-shipping ports waxed and waned in the Chesapeake country, where Baltimore flourished because it was able to capture the wheat trade of the Susquehanna Valley.

David R. Goldfield examines the evolution of municipal institutions in the South between 1820 and 1860. A leadership class emerged, slavery was easily adapted to urban needs, and charter revision enabled local government to play an increasing role in urban affairs, including the provision of water and sewer systems and of fire and police protection. He concludes that secession was opposed by cities whose market ties were with the North.

Howard N. Rabinowitz describes the shift from a river and seaport orientation in 1860 to the railroad orientation of 1900. Southern railroads were consolidated under the control of northern bankers and managers after the Panic of 1873. Commerce and administration remained more important than manufacturing in most southern cities. Rural blacks had begun to move into cities, to the dismay of the white residents, and black slums developed in areas considered unfit for white habitation. Streetcars permitted the expansion of built-up areas and encouraged large-scale annexations.

Blaine A. Brownell can find few differences between cities in the South and those in the rest of the nation between 1900 and 1940, although he does discuss residential segregation in some detail. Edward F. Haas zips right along when he describes the history of politics in New Orleans between 1945 and 1965. He sees the civil rights revolution in the South largely in terms of an urban-rural conflict.

Haas has been badly served by his editors, who have let his "footnotes" become badly jumbled, and all of the authors have been badly served by their publisher, who has consigned all of the notes to a Jim Crow section at the back of the book. Then again, perhaps it was not so unkind to bury the notes in this fashion, because the quality of scholarship does give one pause. Debatable ideas are asserted as facts, even though they are undocumented or are documented so vaguely that it is almost impossible to track down the original source; and some items seem to have been cited merely as name-droppings, to show that the author is aware of their existence, not because they are relevant to the argument he is trying to develop. It appears that historians, or at least the particular set of historians who prepared these essays, are just as parochial as geographers are often accused of being, because parts of the book could have been written only by someone in complete ignorance of the geographical literature (the nod of obeisance on page 20 notwithstanding).

Much of the book is about institutions, not about places; much of the evidence is distressingly anecdotal; and most of the anecdotes are drawn from a mere handful of metropolitan areas, whereas perhaps the most distinctive urban place of the South is the town of 1,000 to 10,000 persons, of which the region has far more than its share.

One finishes the book with a sad feeling of emptiness, because so many fascinating topics have been left untouched. The growth of the Carolina Piedmont textile towns, for example, receives cavalier treatment, the boomtowns of the Texas-Louisiana Oil Coast are scarcely mentioned, and almost nothing is said about the impact of military bases and the aerospace industries on towns nearby. One may quite properly dismiss the notion of a "Sun Belt" as journalese, but certainly recreation, resort, and retirement centers have had a powerful effect on recent urban growth in the South. Finally, in a book that purports to deal with "the complex patterns of urban race relations" one might have expected to find some discussion of the transformation of the older residential patterns (whites in houses on the paved streets, their

black servants in shacks on the unpaved alleys behind) into ghettos, and of the problems posed for those who wished to create racially segregated school districts by this tightly interdigitated street-and-alley racial residential pattern.—JOHN FRASER HART

THE NATIVE POPULATION OF THE AMERICAS IN 1492. Edited by WILLIAM M. DENEVAN. xxii and 353 pp.; maps, diagrs., bibliogr., index. The University of Wisconsin Press, Madison and London, 1976. \$15.00. 9¼ x 6 inches.

Few topics in the history and human geography of the Americas have sparked as much academic controversy as the question of the size of the aboriginal population in the New World at the time of European contact. The question may never be resolved, simply because adequate demographic data for the period are not available. The lack of data has not, however, curbed the publication of an array of differing population estimates by many scholars during the past several decades. For example, estimates of hemispheric totals vary from 8 million to more than 100 million souls. Scholars of the subject form two camps: those who favor a large total of native population, and those who are inclined toward smaller estimates. The former group have been led mainly by members of the "Berkeley school," which includes the historians Lesley B. Simpson and Woodrow Borah and the physiologist Sherburne F. Cook; the conservatives have followed the American anthropologists Alfred L. Kroeber and Julian H. Steward and the Venezuelan philologist Angel Rosenblat. Regardless of the original population size, there is little doubt that the New World aborigines suffered a disastrous decline in numbers after European contact, mainly through the inadvertent introduction of Old World diseases and through the disruption of delicately balanced subsistence systems. Some scholars have calculated that within a century after Spanish Conquest the highly civilized Indians of central Mexico, for example, had lost 95 percent of their 1519 population.

William M. Denevan has assembled eight new essays on this controversial subject, representing both liberal and conservative views. The essays are organized into five categories. In one, on methodology, Woodrow Borah, perhaps the most outspoken proponent of large populations for pre-Columbian America, reviews the various techniques that have been used to arrive at estimates for the colonial and precolonial periods. The remaining categories are regional. The Caribbean and Central America are represented by Angel Rosenblat's essay on the pre-Columbian population of Hispaniola and by David R. Radell's paper on that of Nicaragua. Mexico is handled by William T. Sanders, who treats the population of the Valley of Mexico in the sixteenth century. For South America there are three essays: Daniel E. Shea writes on the population of the central Andes in 1520, Jane Pyle on aboriginal population estimates of Argentina, and William Denevan on those of Amazonia. North America is covered by Douglas H. Ubelaker, who deals with James Mooney's estimates of Indian populations, made in 1910.

The editor has prefaced each of the five parts with an introduction, in which he reviews the relevant literature and the main problems. This laudable format results in a volume far more coherent and meaningful than most collections of papers written on a particular subject by a variety of authors.

Each of the regional essays emphasizes a particular method of estimating aboriginal populations. Rosenblat's paper on Hispaniola exemplifies the ultraconservative view still held by older scholars. Discounting the large numbers of Indians reported by early Spaniards as gross exaggerations, Rosenblat maintains, as he did in 1935, that Hispaniola contained no more than 100,000 souls in 1492, despite later studies that place the total between 1 and 8 million! The longest and perhaps most provocative essay is by William Sanders on the Valley of Mexico and adjacent areas. Basing his calculations on archaeological, ecological, and documentary records, Sanders concludes that the population of central Mexico at Spanish contact could not have exceeded 11,400,000, a total less than half of that calculated by Woodrow Borah and Sherburne F. Cook (25,200,000) in their renowned monograph, "The Aboriginal Population of Central Mexico on the Eve of the Spanish Conquest" (*Ibero-Americana*, Vol. 45, 1963). The divergent

totals stem partly from differing methods of projecting backward to 1519 the curves of population decline calculated from sixteenth-century Spanish records. Shea employs a mathematical model to project backward to 1520 decline rates based on sixteenth-century tribute records and comes up with the conservative total of about 3 million Indians for the central Andes, a total far below previous estimates of 6 to 12 million. Pyle has simply reworked available colonial records for Argentina and concludes that previous estimates for the area should be doubled. Denevan uses a "habitat-density" method to estimate the population of the Amazon Basin; the technique extends a known density for a group in a particular habitat to comparable habitats within Amazonia. He arrives at 6.8 million for the area, a total much greater than previous estimates.

This collection of essays indicates that the differences between scholars regarding the size of aboriginal populations in the Americas are greater than ever. It also indicates that refined methods in statistics, ecology, and archaeology are increasingly being used in such studies. Nonetheless, the guessing game continues.—ROBERT C. WEST

ABSTRACTS OF ARTICLES

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The City: Its Distance from Nature

YI-FU TUAN

Cities are artifacts and worlds of artifice placed at varying distances from states close to nature. They can be arranged along a scale, using the physical criteria of 1) cutting agricultural ties, 2) civilizing winter, and 3) conquering night. Ancient cities, despite their monumental facades, had close ties with the countryside. Agriculture remained an important activity in English cities at the height of the Industrial Revolution. Whereas the country comes to life in the warm season, the glamorous metropolis blooms in winter. The natural rhythm of day and night, of work and rest, is disrupted in the city whose cultural status is measured by the vigor of its night life. Artificial lighting, a recent technological triumph in the long history of the city, can turn night into day. Cities differ greatly in their distance from livelihoods intimately tied to nature.

Rural and Small-Town Depopulation in Colombia

LYNDEN S. WILLIAMS and ERNST C. GRIFFIN

Rural population decline as a result of emigration is a noteworthy characteristic of the densely settled highlands of Colombia. The process of rural depopulation was noticeable in the 1950's and has since become more pronounced. Small-town depopulation is also occurring, though to a more limited extent. In the 1960's rural and small-town depopulation also occurred in some lowland zones that are often assumed to be pioneer areas. An absolute population decline in rural areas provides a basis for improving the man/resource base in rural areas and may ameliorate other demographic problems. Further research is needed to determine whether rural depopulation is having the desired effect and whether the process is occurring in other Latin American countries.

African Politics and Port Expansion at Dar es Salaam

B. S. HOYLE

In 1965 Rhodesia unilaterally and illegally declared political independence; in 1975 a new Chinese-sponsored railway linking the Tanzanian seaport of Dar es Salaam and the Zambian Copperbelt was opened. In the intervening years, as a result of changing geopolitical conditions in central and eastern Africa, Zambia severed her transport links with southern Africa and developed new links with Tanzania. These politically stimulated changes have brought particular pressures to bear on the port of Dar es Salaam, where facilities have been expanded and where throughput has grown at an unprecedented rate. These developments are examined as an illustration of the complex interrelationships between transport geography and political changes in modern Africa.

A Staple Interpretation of Slavery and Free Labor

CARVILLE V. EARLE

The geography of slavery and free labor in the pre-1860 United States is interpreted as a rational economic response to the prevailing regional staples and the costs and returns of slave and free labor. Northern farmers rejected slavery because slaves were more expensive than hired day labor in producing the wheat staple, not on grounds of moral-ideological repugnance, as some have suggested. Regions of staple change invited pressures for labor adjustment. Free labor displaced slaves in the colonial Chesapeake, and slavery threatened free labor in the antebellum Midwest. The imminence of slavery in the 1830's Midwest sheds new light on regional politics and on the urgency of the Civil War.

No-Till Farming: The Regional Applicability of a Revolutionary Agricultural Technology

PHILIP J. GERSMEHL

No-till farming is a revolutionary system of crop production without plowing or other extensive soil manipulation. Proponents predict a rapid spread of the new technology, but a geographical analysis of the present limited distribution of no-till cornfields suggests that diffusion is limited by the low soil temperatures northward, unreliable rains westward, and weed efficiency southward. Moreover, the adoption of no-till techniques in the Midwest is hindered by a combination of economic and psychological characteristics of Corn Belt farmers. The regional differences in the applicability of no-till farming should be considered by those who are studying the new system as a solution for some of the complex problems of agricultural use of energy and impact on environment.

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WINDBREAKS IN THE LOWER RHONE VALLEY*

DANIEL W. GADE

DENSELY spaced hedgerows form the dominant landscape motif wherever they are found. These rectilinear arrangements of trees or shrubs occur in areas of differing physical, cultural, or economic complexity, and the motives for their implantation and persistence are diverse.¹ Unlike the hedges of northwestern Europe that have long served a variety of purposes, those in the south of France are used mostly for wind abatement. The exceptional density of windbreaks in the flat, irrigated zones of Provence (Fig. 1) provokes reflection on their origin, composition, and perceived role in a specialized and dynamic agricultural system.

THE MISTRAL

Hedges in the lower Rhone region are designed to check the strong north wind that sweeps through the valley into the Mediterranean Sea. This wind has been known as the mistral only since the sixteenth century, but its effects have been recorded since antiquity.² The impact of the mistral is pervasive. Tree crowns manifest wind shear, and in autumn leaf fall is accelerated.³ Subtropical species, such as date palm, orange, and mimosa, which grow on the protected coast east of Marseille, are precluded in the Rhone valley. Likewise, production of cut flowers, an important use of agricultural land on the Riviera, is insignificant in the Rhone region. On occasion the mistral has delayed trains, hindered aviation, turned over carts, and

* This study was facilitated by a year-long sabbatical leave in 1973 from the University of Vermont. Mary Killgore Gade assisted in fieldwork, made useful comments on successive drafts, and, with Katharine Anderson, prepared the maps.

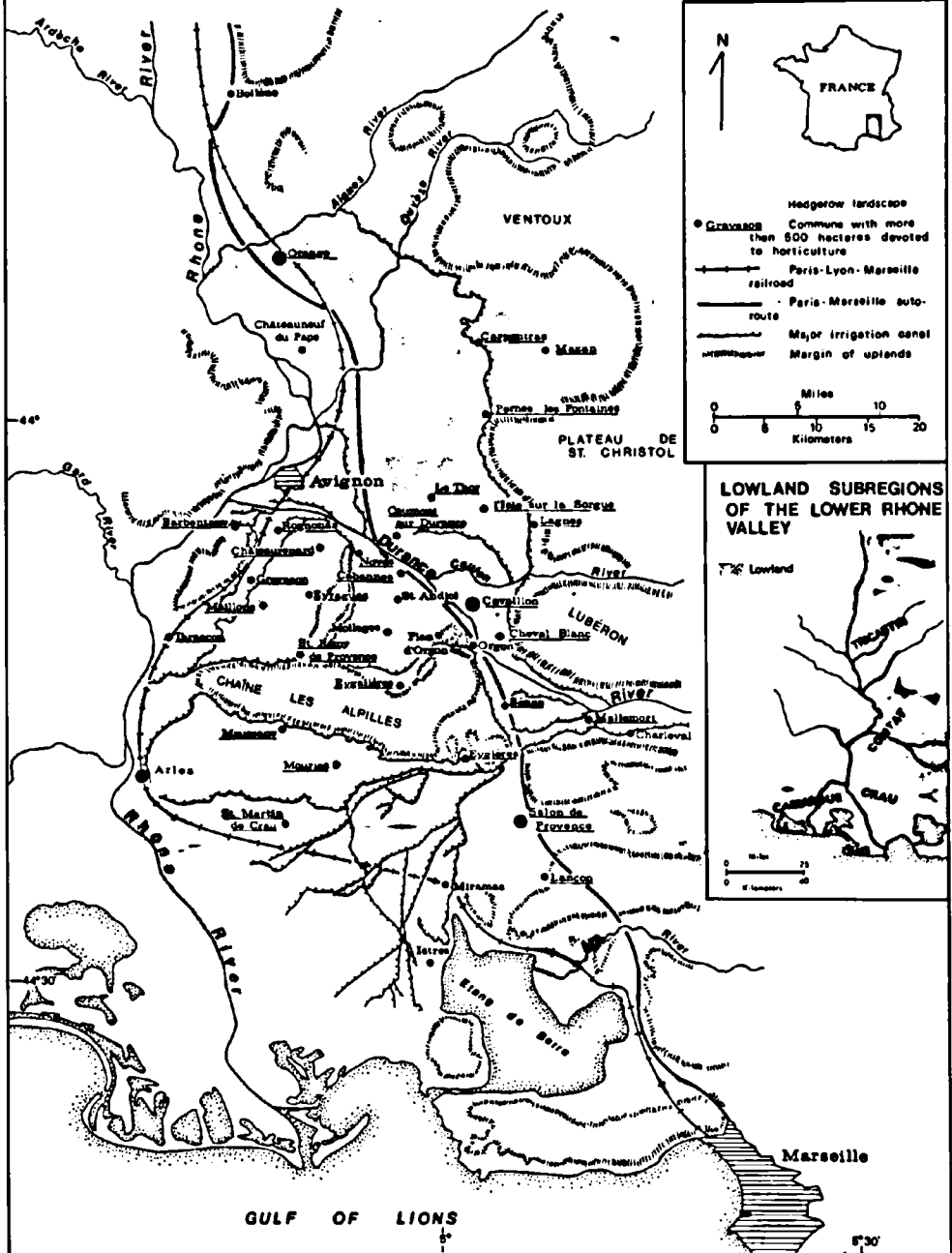
¹ Some of the diversity in the layout and composition of hedgerows is discussed by E. Aubert de la Rüe: *Remarques sur divers types de clôtures d'origine végétale*, *Journal d'agriculture tropicale et de botanique appliquée*, Vol. 15, 1968, pp. 213-242. See also F. N. Howes: Fence and Barrier Plants in Warm Climates, *Kew Bulletin*, No. 2, 1946, pp. 51-87.

² Pliny: *Natural History* (Harvard Univ. Press, Cambridge, Mass., 1950), p. 15; and "Diodorus of Sicily" (Harvard Univ. Press, Cambridge, Mass., 1939), p. 165. In "The Geography of Strabo" (I. G. P. Putnam's Sons, New York, 1923), p. 185) one reads that in the Mediterranean portion of Gaul "the whole of the country . . . is exposed to the winds; the Black North, a violent and chilly wind, descends upon this plain with exceptional severity."

³ Dietrich Barsch: *Wind, Baumform und Landschaft. Eine Untersuchung des Windeinflusses auf Baumform und Kulturlandschaft am Beispiel des Mistralgebietes im französischen Rhônetal*, *Freiburger Geogr. Hefte*, Vol. 1, 1963, pp. 21-130.

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HEDGEROW LANDSCAPE OF THE LOWER RHONE VALLEY



torn off roof tiles. The negative effects of this wind on the human nervous system are part of regional folklore.

The inordinately high frequency and velocity of the mistral were once thought to be the result of the removal of forests on the surrounding mountains, and tree planting on a massive scale was viewed as the appropriate means of combating the wind.⁴ In the second half of the nineteenth century this explanation was part of a larger argument over the influence of vegetation on climate. Since the 1930's, however, the mistral has been recognized as the result of one of two kinds of atmospheric pressure differences.⁵ Normally it is caused by a continental pressure gradient when a depression develops over the Mediterranean Sea as an anticyclone advances from the west over central France. In the absence of such a circulation pattern a somewhat weaker mistral can develop as a downslope wind that flows from surrounding uplands to the river plains below. In both the general and the local mistrals, velocities increase as the air funnels through the Rhone corridor (Fig. 2). Starting near Valence, the mistral increases in speed as it passes Montélimar, Orange, Avignon, and Arles. On the outer delta plain it may be checked by the sea breeze, or it may continue over the Gulf of Lions. An exceptionally strong mistral can result from the general circulation pattern combined with a katabatic flow whose speed is heightened to a howling force as it swoops through the valley.

In popular usage the mistral is any strong, relentless wind; however, it is defined meteorologically as a wind with an average speed of at least 5 meters per second (m/s) at the ground, which lasts a minimum of 6 hours and is confined between 280° and 360° of the wind rose. Using these criteria, the mistral in the lower Rhone blows a third of the year from 4 (moderate breeze) to 9 (strong gale) on the Beaufort scale.⁶ April is the month of strongest winds. At Marignane, observations from 1957 to 1966 show that 45 percent of all the mistral winds were 10 m/s or more in velocity and that 39 percent of them came from 320°. At Istres, 34 percent of the wind frequencies, whether of mistral force or not, comprise winds from the northwest or north-northwest (Fig. 2 inset).

EVOLUTION OF LAND USE IN THE LOWER RHONE REGION OF PROVENCE

The mistral has varied less through time than has perception of its impact. Farmers and herders had worked the lower Rhone valley many centuries before wind protection became a matter of serious concern. Until about 1850 agriculture on the

⁴ B. Rougier de la Bergerie: *Les Forêts de la France* (Arthus Bertrand, Paris, 1817), p. 224; and N. Toulouzan: *Du Mistral ou vent du nord-ouest et des moyens d'en éviter les funestes effets par rapport à l'agriculture de la Basse-Provence*, *Annales provençales d'agriculture pratique et d'économie rurale*, No. 7, 1828, pp. 272-280, reference on pp. 272-273. The historian Charles de Ribbè asserted in "La Provence au point de vue des bois, des torrents et des inondations avant et après 1789" ([Guillaumin, Paris, 1857]) that the mistral became more destructive after the forests of the Cévennes had largely been removed in the sixteenth century. This statement was repeated by George Perkins Marsh in "Man and Nature; or, Physical Geography as Modified by Human Action" ([Charles Scribner, New York, 1864], p. 153).

⁵ E. Rougetet: *Le Mistral dans les plaines du Rhône moyen entre Bas-Dauphiné et Provence*, *La Météorologie*, Vol. 6, 1930, pp. 341-385; and J. Corbel: *La Violence des vents dans le couloir rhodanien*, *Revue de géographie de Lyon*, Vol. 37, 1962, pp. 273-286.

⁶ Unpublished climatic statistics from the Institut de la Météorologie Nationale at La Galice (Aix-en-Provence) for Bouches-du-Rhône, and the Département de Bioclimatologie, Institut National de la Recherche Agronomique at Montfavet (Avignon) for Vaucluse.

⁷ F. Boyer, A. Orieux, and E. Pouget: *Le Mistral en Provence occidentale*, *Monographie No. 79 de la Météorologie Nationale*, Ministère des Transports, Paris, 1970, pp. 8-9.

depositional plains was adapted to the winter rains and summer drought, and the land was held in large estates worked by sharecroppers. Then competition from abroad cut into the national market of wheat and olive oil, while oidium and phylloxera nearly wiped out the vine. Two other key crops to lose prominence in the late nineteenth century were madder, which was replaced by synthetic alizarin as a source of red dye, and mulberry, which declined abruptly after a silkworm disease and competition from Asian silk curtailed demand for its leaves. Irrigated market gardens and orchards rapidly filled the land use vacuum. Owner-operated, dispersed farms of three to five irrigated hectares began to replace the large landholdings and clustered settlements.

As early as the Middle Ages small, local irrigated gardens had begun to supply Cavaillon and Avignon with fruits and vegetables.⁸ In the thirteenth century at Cavaillon, water used to operate mills was diverted from a canal in order to irrigate plots on the southeastern side of Mont St. Jacques, a 180-meter-high inselberg. Horticulture expanded from these two small centers to dominate the agricultural economy of the lower Rhone valley only when technological developments permitted farmers to take advantage of a growing season of over 220 days and of the more than 2,500 hours of sunshine a year. The construction or expansion of several large irrigation canals from the alpine-fed Durance River provided the water necessary for this transformation.⁹ However, the horticultural future of the lower Rhone only became assured when completion of the Paris-Lyon-Marseille railroad in 1856 made possible the overnight delivery of produce to the large cities of northwestern Europe. In 1867 a daily wholesale market, which later became the largest fresh produce market on the European continent at the place of production, was opened at Châteaurenard.¹⁰ After 1880 affluent urban populations demanded more out-of-season fresh fruits and vegetables, which previously had been available only during the summer or early autumn. The emphasis placed on growing and selling such *primeurs* has remained the cachet of horticulture in the lower Rhone.

By the turn of the nineteenth century most of the Comtat plains, formed by alluvium deposited largely by the Durance River, was transformed into a continuous irrigated area between Carpentras and St. Rémy de Provence.¹¹ Horticulture expanded later to the Tricastin in the northern marchlands of Provence. South of the Alpilles anticline, several other zones of the lower Rhone region acquired truck farms and orchards. The Crau, an exceptionally flat, stony surface that comprises the ancient delta of the Durance, was changed from extensive sheep raising to intensive horticulture, especially on its eastern and northern margins. A small truck-farming zone was established on the delta of the Arc River and in the Camargue on some of

⁸ C. de Villeneuve: *Statistique du Département des Bouches-du-Rhône* (4 vols.; Imprimerie de Feissat aîné, Marseille, 1821-1829), Vol. 4, pp. 132 and 157-158.

⁹ Several important regional studies by French geographers emphasize the role of water in the agricultural transformation of the lower Rhone. See Marius Peyre: *Les Irrigations de la Basse Durance*, *Annales de géogr.*, Vol. 36, 1927, pp. 40-57; Pierre George: *La Région du Bas-Rhône* (J. B. Baillière et Fils, Paris, 1935); Roger Livet: *Habitat rural et structures agraires en Basse-Provence*, *Annales de la Faculté des Lettres Aix-en-Provence*, N.S., No. 32, 1962; Daniel Faucher: *L'Homme et le Rhône* (Gallimard, Paris, 1968); and Jacques Bethemont: *Le Thème de l'eau dans la vallée du Rhône* (Imprimerie le Feuillet Blanc, St. Étienne, 1972).

¹⁰ Guy Daudé: *L'Agriculture de Châteaurenard: tradition, difficultés et perspectives*, *Revue de géographie de Lyon*, Vol. 47, 1972, pp. 167-219, reference on p. 167.

¹¹ E. Bergounhous and P. Masson: *Les Bouches-du-Rhône: encyclopédie départementale* (15 vols.; Conseil Général du Département des Bouches-du-Rhône, Marseille, 1913-1933), Vol. 15, p. 452.

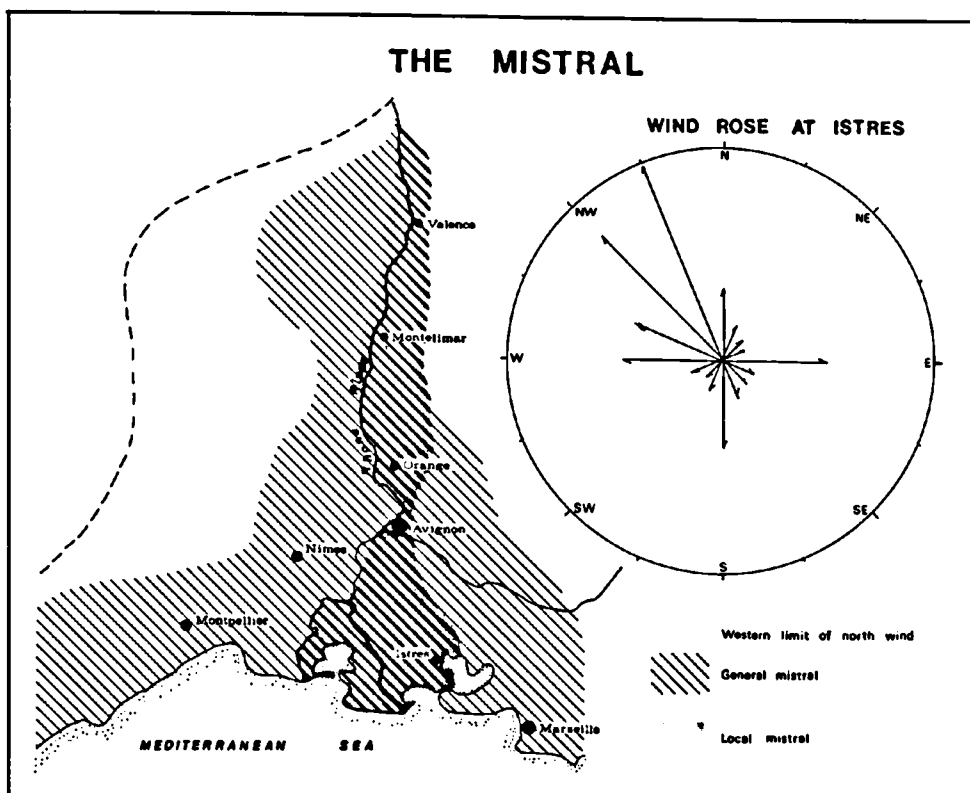


FIG. 2—The mistral. Map adapted from Rougetet, *op. cit.* [see text footnote 5].

the humid alluvial spaces between the Rhone river channel and dikes.¹² In the lower Rhone region as a whole, horticulture continued to expand into the late 1960's, owing partly to the enterprise of Frenchmen repatriated from North Africa.

Land on the thousands of tiny farms is worked almost continuously. Two, three, or even four successive crops a year are harvested from the same plot. Maintenance of high yields demands prodigious applications of chemical fertilizers, herbicides, and fungicides, as well as irrigation water every three or four days in the summer. Although garden tractors and rototillers are used, many of the tasks, including sowing, transplanting, weeding, watering, harvesting, and sorting, are accomplished by manual labor. *Marâchage* (vegetables and ground fruits) and fruit trees are more often than not combined on the same farm because diversity of crops staggers the work schedule and spreads the risk.¹³ The busiest harvest period, for the region as a whole, falls between April 15 and June 1, although crops are picked during much of the year. Carrots, peas, asparagus, and strawberries are followed by tomatoes, eggplant, early potatoes, squash, and melons. Cherries, peaches, apricots, pears, apples, and table grapes appear between May and October. Cauliflower, cabbage, artichokes, salad greens, beans, and onions mature later in the year.

¹² Roger Livet: Problèmes de colonisation rurale actuelle dans le sud-est français, *Bull. de la section de géographie du comité des travaux historiques et scientifiques*, Vol. 76, 1963, pp. 241-306, reference on p. 287.

¹³ For a description of regional crop emphases see René Grosso: La Répartition actuelle des cultures comtadines, *Méditerranée*, No. 24, 1976, pp. 51-58.

Human intervention was essential to this agricultural transformation of the lower Rhone. Irrigation freed crop production from a meager and seasonal rainfall, which averages only between 600 and 700 millimeters a year. Next in importance was taming the mistral with hedgerows to protect crops from the strong wind. Rhone farmers are unequivocal about the necessity, for if the wind blows unobstructed, leaves and stems of tender vegetables tear and break, flowers and fruit on orchard trees fall prematurely, and fruit is bruised by adjacent foliage. Windflaws can impede pollination by insects and can unevenly distribute irrigation water from overhead sprinklers. The evaporating capacity of strong air currents may be more harmful than their mechanical effects. Even with an abundance of irrigation water, stomata on the leaf surface of crops close during windy periods in the hot summer months if insufficient moisture is brought into the plant from the roots. Thus constant high evapotranspiration in unsheltered fields decreases yields by slowing down photosynthesis.¹⁴

The mistral also brings with it dangerously low temperatures for crops in the low-sun half of the year. The location of irrigated fields on the flat valley lands increases the vulnerability of tender crops to cold air drainage. Advection frosts down to or below 0°C. can be expected to afflict the region from forty to fifty days a year spread over a period of five months. The last killing frost in the lower Rhone valley normally occurs in the fourth week of March. Spring is, therefore, the most critical time of the year for the Rhone horticulturalists who depend on primeurs for part if not all of their farm income. Shelter is most crucial in March and April, when young plants are exposed to undependable temperatures and uncommonly high wind velocities. At the other end of the growing season, freezing temperatures in November and occasionally in late October endanger autumn crops. The fundamental agricultural solution to decelerating the cold, dry gusts throughout the year has been to establish a close succession of hedge ramparts. Comparative studies elsewhere have shown that fruits and vegetables are among the crops most responsive to windbreak protection.¹⁵ Unlike certain other areas of the world, however, the windbreaks in the Rhone were not primarily designed to increase yields or to allow successful cultivation of semi-tropical plants. Instead, windbreaks in this region protect mid-latitude crops against a normal climatic element that could destroy them if shelter were not provided. Other advantages of hedgerows were recognized later as the quest for precocity intensified.

DEVELOPMENT OF THE HEDGEROW

At least as early as the seventeenth century, rows of trees were planted on some field borders and along roads in Provence to replace wood lost from overcut and overgrazed forests.¹⁶ Agronomists and large landowners in the Midi later promoted the multipurpose enclosure, which derived from the bocage of humid western France.¹⁷ The mixtures of deciduous and evergreen broad-leaved trees and shrubs

¹⁴ R. J. Bouchet: Évapotranspiration réelle, évapotranspiration potentielle, et production agricole, *Annales agronomiques*, Vol. 14, 1963, pp. 743-824.

¹⁵ J. H. Stoeckeler: The Design of Shelterbelts in Relation to Crop Yield Improvement, *World Crops*, Vol. 17, 1965, pp. 27-32.

¹⁶ Abbé de Coriolis: Traité sur l'administration du comté de Provence (Imprimerie d'Angus Adibert, Aix-en-Provence, 1786), p. 391; and A. Clapier: Des Bois taillis et de leur culture en Provence, *Annales provençales*, No. 107-108, 1836, pp. 406-431, reference on p. 409.

¹⁷ E. H. Boyer de Fonscolombe: Mémoire sur la destruction et le rétablissement des bois dans les départements qui composoient la Provence, *Mémoires de la Société des Lettres, de l'Agriculture et des Arts d'Aix*, Vol. 1, 1819, pp. 1-87, reference on pp. 84-85; Toulouzan, Du Mistral [see footnote 4 above], pp. 277-278;

formed a thorny barrier, yielded edible fruit, medicinals, dye plants, and firewood—and only as an afterthought served as a windbreak.¹⁸ Many of the old-style hedges, which include small trees of hawthorn, plum, medlar, apple, quince, pear, hazel, jujube, elm, elder, and white mulberry, survived. However diverse their taxonomic components, these hedgerows were not numerous enough to warrant characterizing the lower Rhone landscape as bocage.¹⁹

Hedgerow planting acquired the much narrower function of a windbreak when irrigated horticulture began to spread in the 1830's.²⁰ By then observers had indicated the protective advantages of various kinds of barriers when standing crops were confronted with the brute force of desiccating high wind velocities.²¹ Outcrops, ridges, and other physiographical barriers provided at best incomplete protection. Walls were not seriously considered as an alternative measure over large areas, in spite of the abundance of stone and masonry materials, for they required excessive amounts of upkeep, set up strong wind eddies, and were sometimes destroyed in severe windstorms. Lines of living or dead plant material became the regionally accepted means of attenuating the mistral, but the floristically diverse hedgerows planted in pre-revolutionary Provence did not satisfactorily meet the perceived needs of market gardeners or orchardists for effective wind protection for their crops, for their homesteads, or for themselves.

Attention turned to the pyramidal variety of Mediterranean cypress (*Cupressus sempervirens* var. *pyramidalis*), a fastigate evergreen known in southern Europe since classical times and long planted in formal gardens as an ornamental.²² Between 1840 and 1920 horticulturalists in the lower Rhone valley set out rows of pyramidal cypress almost to the exclusion of other living hedge species. The planting of cypress hedges in most of the Comtat was synchronous with the transition to irrigated market gardening and orcharding. In the windswept Crau, these dark green sentinels were established early enough in places to be incorporated into several of the brooding landscapes painted by Vincent Van Gogh between 1888 and 1890.²³ The major reason for

M. Feissat: Des Plantations, *Annales provençales*, No. 9, 1828, pp. 321-351, reference on p. 322; and M. Briet: Plantation et formation des haies vives, *ibid.*, No. 31, 1830, pp. 300-302. The larger context of hedgerow influence in France is elaborated in André J. Bourde: *Agronomie et agronomes en France au XVIII^e siècle* (3 vols.; S.E.V.P.E.N., Paris, 1967), Vol. 1, pp. 546-557.

¹⁸ Pierre-Joseph Amoureux: *Mémoire sur les haies destinées à la clôture des prés, des champs, des vignes* (Cuchet, Paris, 1787); François Rozier: *Cours complet d'agriculture théorique, économique et de médecine rurale et vétérinaire* (9 vols.; Hotel Serpente, Paris, 1781-1796), Vol. 3, pp. 407-408, and Vol. 5, pp. 405-422; Villeneuve, *op. cit.* [see footnote 8 above], Vol. 4, p. 157.

¹⁹ Observant travelers who noted hedgerows elsewhere in France made no mention of them when they reported on the lush market gardens at Cavaillon. See Locke's "Travels in France 1675-1679" (edited by John Lough; Cambridge Univ. Press, Cambridge, 1953), pp. 84-85; Arthur Young: *Voyages en France pendant les années 1787-88-89 et 90* (2nd edit.; 3 vols.; Buisson, Paris, 1794), Vol. 2, pp. 476-477; and A.-L. Millin: *Voyages dans les départements du Midi de la France* (5 vols.; Imprimerie Impériale, Paris, 1807), Vol. 4, p. 88.

²⁰ L. Duhamel: *Annuaire administratif, historique et statistique de Vaucluse: année 1897* (Paul Bernard & C^{ie}, Avignon, 1897), p. 36.

²¹ Toulouzan, Du Mistral [see footnote 4 above], pp. 275-276; *idem*, *Considérations sur la direction à donner à l'agriculture de la Rasse-Provence*, *Annales provençales*, No. 40-41, 1830, pp. 143-185, reference on p. 183; and Antoine-César Becquerel: *Des Climats et de l'influence qu'exercent les sols boisés et non boisés* (Didot frères, Paris, 1853), p. 116.

²² M. Garidol: *Histoire des plantes qui naissent aux environs d'Aix et dans plusieurs autres endroits de la Provence* (Joseph David, Aix-en-Provence, 1715), pp. 137-139.

²³ Louis Castagne: *Observations sur le reboisement des montagnes et des terrains vagues dans le département des Bouches-du-Rhône*, *Mémoires de l'Académie d'Aix*, Vol. 6, 1845, pp. 437-496, reference on pp. 480-481.



FIG. 3.—Three-tiered wind shelter near l'Isle sur la Sorgue: trimmed Mediterranean cypress in the background; maize planted as a strip barrier in the field; and polyethylene film.

the wide acceptance of cypress in the Rhone valley was its 80 percent impenetrability to wind, made possible by branches that grow parallel to the straight trunk and by scale leaves that form a compact foliage. Cypress saplings, transplanted to the line two years after germination in a seedbed, are placed in the ground half a meter to a meter apart. In four or five years the trees coalesce to form a dense, even obstruction to the wind (Fig. 3). However, aging cypress trees tend to lose leaves near the base, a pervious interstice that must be closed to prevent air from funneling through to the other side. Unlike many trees, cypress can withstand severe trimming, and its wood is rot-resistant.

The other major hedgerow species in the lower Rhone valley is white poplar (*Populus alba*), several varieties of which have been introduced to the south of France from Italy and Turkey. With an impermeability to wind of only about 30 percent, a white poplar hedge filters rather than obstructs the airflow. For this reason orchardists now prefer poplar to cypress as a windbreak. Because fruit trees are dormant in winter the deciduous habit is no serious disadvantage, and in summer, some sunshine filters through the trees to promote the development of sugar in the fruit. The use of poplar in hedges has expanded greatly in the lower Rhone at the expense of cypress, particularly since the 1950's (Fig. 4). White poplar is less vulnerable to freezing temperatures and uprooting, which destroys cypress when unusually strong winds



FIG. 4—A white poplar hedge flanked on the north by Arizona cypress protects a peach orchard near Salon de Provence.

rage.²⁴ Readily propagated by cuttings that can be set out immediately on the hedge line, poplar grows three times as rapidly as cypress. Being more open, poplar withstands wind shear and does not require close attention to trimming. Negative qualities of poplar are an inability to cope with drought, a life span of only about twenty years, and far-reaching roots that can penetrate foundations.

Pyramidal cypress and white poplar are used in an estimated 75 percent of the quickset hedgerows in the lower Rhone. A few other species of hedge trees have found some favor as windbreaks. A columnar variety of Oriental arborvitae (*Platycladus orientalis*) has been planted for decades as a substitute for cypress. It is now locally abundant in parts of the Comtat. Wide acceptance of arborvitae has been hindered by its slow growth, its aversion to calcareous soils, and its high water demands. Cypress other than the pyramidal variety has been planted in recent decades, but none as yet are in contention to dominate the hedgerow. The spreading branches of the horizontal variety of Mediterranean cypress (*C. sempervirens horizontalis*) have greater permeability than those of its fastigate relative, but few of the other virtues of poplar.

²⁴ The notorious windstorm of February, 1929, which attained the hurricane force of 41.6 m/s, destroyed many cypress hedges because of their impermeability, as well as many truck crops, but it did not severely damage vine plantings or orchard trees (Chambre d'agriculture des Bouches-du-Rhône pour 1929, Archives départementales des Bouches-du-Rhône, Marseille).

Two native American species that have received increasing attention because of their rapid growth and their resistance to disease are the Arizona cypress (*C. arizonica*) and the Monterey cypress (*C. macrocarpa*). The former has so far proved superior to the latter, which cannot survive hard freezes and does not thrive in lime-rich soils. Bay laurel (*Laurel nobilis*), a tall evergreen shrub with dense, aromatic foliage, and tamarisk (*Tamarix* spp.), very tolerant of salty soil, have been only nominally used as windbreaks in the Rhone valley. Tall annual plants such as maize or sunflower are occasionally planted as a kind of shelter, but their absence in early spring does not make them satisfactory windbreaks. As for trees, one or several alternative species could emerge to replace or complement the two that still dominate in the region. Troublesome pests, most notably canker fungus on pyramidal cypress and a coleopterous insect that attacks poplar, point to the need for a greater diversification of hedge components.

The giant reed grass or arundo (*Arundo donax*), a woody-stemmed perennial about three meters high, also acts as a windbreak in the lower Rhone. Though locally known as *canne de Provence*, this species was probably brought to the south of France from the eastern Mediterranean in ancient times. It has a long tradition as one of the most useful plants in the Midi and is one of the first materials to be used for windbreaks in the Rhone region.²⁵ This graminoid thrives with little encouragement on the banks of irrigation canals and in roadside ditches, thus stabilizing humid places with its spreading rhizomes. Planted in strips next to crop fields, arundo can serve as a living windbreak, but it is used more often as the material for a dead hedge. The culms, cut in late winter after the second year of growth and dried in stacks, are fashioned into a screen known as a *cannisse*. Canes are either lashed together with wire or inserted into the ground to form a palisade, the latter a less common but longer-lasting procedure. The reed screen has the advantages of being movable, chary of space, and made from a locally abundant raw material (Fig. 5). It may be placed between quickset hedgerows to provide additional protection or at the base of hedges to close breaches that let wind pass. In areas newly opened to horticulture, fences of dried cane provide an immediate buffer until the quickset hedge is tall enough and dense enough to be effective.

HEDGEROW FORM AND FUNCTION

Whatever the species they comprise, hedgerows in the south of France offer the advantages of some protection against the damaging effects of high wind velocities on plants and soil and of the creation of a favorable microclimate for accelerated crop maturation.²⁶ Quickset trees are most often planted perpendicular to the prevailing wind in a single row which takes one or two meters away from cropping space. The high cost of land precludes wide belts of trees that would increase wind protection. On both sides of the hedge, earthen banks about half a meter high help to check the

²⁵ N. Toulouzan: Culture et usage des roseaux, *Annales provençales*, No. 22, 1829, pp. 385-394.

²⁶ A copious world literature is available on the influence of different kinds of windbreaks on wind speed, radiation, temperature, humidity, evaporation, soil moisture, carbon dioxide content of the air, and water use efficiency. Most of this work is the result of experimental studies made since 1940. For a synopsis of some of the data, see J. van Eimern, R. Karschon, L. A. Razumora, and G. W. Robertson: Windbreaks and Shelterbelts, *Tech. Note No. 59*, World Meteorol. Organization, Geneva, 1964. Two other digests are Johan van der Linde: Trees Outside the Forest, in *Forest Influences* (Food and Agricultural Organization of the United Nations, Rome, 1962), pp. 141-208; and Gérard Guyot: Les Brise-vent: modification des microclimats et amélioration de la production agricole, *Annales agronomiques*, Vol. 14, 1963, pp. 429-488.

spread of tree roots into adjacent agricultural land, and also offer some protection to crops from winds near the ground. A quickset row, homogeneous when planted, will in time be joined by shrubs, vines, and small trees of other species. Among the most



FIG. 5—Tomato plants sheltered by arundo screens three meters high and seven meters apart, near Carpentras.

common volunteers are blackthorn, dog rose, sweetbrier, bramble, buckthorn, firethorn, Christ's thorn, spindle, barberry, and privet. These and other spontaneous invaders help to consolidate the windbreak and are usually permitted to remain if impermeability to wind is sought.

The interval between hedgerows is a trade-off between the desired degree of wind protection and competition with crops for sunlight, water, or nutrients. Height and taxonomic composition of the hedge are other variables that explain spacing between alignments. Average wind protection is judged by Rhone horticulturalists to extend

horizontally some ten times the height of the hedge, although actual hedge interval may be from half to twice that distance. Generally the more intensive the land use and the closer the crops to the ground, the lower the hedge and the closer the succession of hedgerows. The height of cypress hedges is controlled far short of their full growth potential, for if they are allowed to grow too high, the shade cast and the space consumed become excessive. Most cypress are trimmed to around five meters, whereas poplar is permitted to grow to three or four times that height.

Depending on the kind of hedge, wind is obstructed or filtered. Wind is deflected when it hits an impermeable cypress windbreak. However, full protection extends for a distance in the lee of only about twice the height of the hedge. Farther away, air that has overtopped the dense barrier forms back eddies that sweep down near the ground.²⁷ The unwelcome turbulence can be partially dissipated by installing reed screens between the quickset rows at appropriate intervals. The less complete protection of a poplar hedge in the first several meters on the lee, however, is compensated for by much less turbulence. Filtering of wind by poplars allows a spacing between rows of fifteen to twenty times the hedge height. Less land is thus taken away from crops with a poplar hedge, but it is judged unsatisfactory shelter for tender ground crops.

In addition to the wind-buffering function, the luminous and thermal advantages provided by hedges have become important to most primeuristes. The lee or southern side of dense quickset and dead hedges has higher temperatures and more sunshine than the northern flank. This difference in exposure is particularly important in spring and autumn, when the low angle of the sun accentuates the shadow on the northern side. Crops planted in the three or four rows closest to the lee of the hedge receive the maximum amount of heat and light, and mature about a week earlier than those planted farther away. Choice vegetables, berries, or melons are planted in this warm band for an early harvest. To maximize the microclimatic advantage on a farm, the dead hedge may be set up at intervals as short as two meters. At the same time, however, the leeward location of a dense live or dead hedge harbors risk of radiation at night because of relatively stagnant air. Crops, and sometimes even land uses, differ on the windward, shadowed side, since maturation is sufficiently delayed there to discourage much emphasis on precocity. Wine grapes or alfalfa, if the farmer still has a horse, may be seen. The frequent appropriation of this shaded strip, tellingly called the "côté mort," as a service road also indicates its lower horticultural value. Hedgerows, particularly poplar, that are more permeable permit less precocity of crops in the lee, but they also involve less risk of damage by frost, which is a major concern with spring-flowering fruit trees.

So important is the benefit of the sunny, lee side that windbreaks are positioned away from the dividing line between properties. Local regulations concerning hedges, some codified, others based on communal tradition, minimize conflict between owners of adjoining property.²⁸ The taller and more substantial the trees, the farther they

²⁷ The aerodynamics of different kinds of hedge barriers was first seriously studied by W. Nageli: *Untersuchungen über die Windverhältnisse im Bereich von Windschutzstreifen, Mitteilungen der Schweizerischen Anstalt für das forstliche Versuchswesen*, Vol. 23, 1943, pp. 22-276. This work led to the realization that a porous hedgerow actually provides better wind protection because it creates less turbulence (Erich J. Plate: *The Aerodynamics of Shelter Belts, Agricultural Meteorology*, Vol. 8, 1971, pp. 203-222).

²⁸ "Annuaire du Département de Vaucluse" (Imprimerie Nillo, Avignon, 1905); Charles Tavernier: *Usages et règlements locaux ayant force de loi dans le Département des Bouches-du-Rhône* (Remondet-Aubin, Aix-en-Provence, 1859); and "Usages locaux à caractère agricole codifiés par la Chambre d'agriculture des Bouches-du-Rhône" (Département des Bouches-du-Rhône, Marseille, 1955).

must be from the boundary line. Many variations occur, however, even in places of similar land use and property sizes. In the communes of Cavaillon and Cheval Blanc, trees and shrubs must be planted at least three meters from the neighboring property line; in Châteaurenard and Graveson, this is reduced to two meters. Trimming is especially important near the line in order to minimize shade for the property owner on the northern side. The commune of Eyragues has made a distinction based on care: three meters from the line if the cypress are not trimmed, but only two meters if they are kept to a height of five meters. In Noves a living hedge may be planted as close as fifty centimeters from the boundary line, provided the hedge is pruned every three years to a height of one meter. Arundo screens may be placed on the property line, but regulations concerning live plantings differ. In Barbentane, clumps of growing reed grass can be located right on the boundary; at Eyragues, fifty centimeters from the line, and at Rognonas, one meter distant. In Noves local usage is more refined and is based on the observation that the roots of reed grass grow southward to seek maximum warmth. If the landowner wishes to plant this species on the southern limit of his property, he is required to bury the rhizome on the northern side of a ditch dug at least 375 millimeters from the boundary.

PROTECTION AND PRECOCITY BEYOND THE HEDGE

In conjunction with hedgerows, other measures have been adopted by Rhone horticulturalists who have emphasized the production of primeurs. Light-colored sandy or pebbly soils that warm up rapidly in early spring and generously reflect light are highly favored. Ridges of soil one meter or so wide are banked toward the south to maximize reception of the sun's rays and are planted with lettuce, parsley, or endive. Forcing beds of horse manure or compost are used for early germination. Smudgepots are occasionally lit to combat unseasonal killing frosts. Water from overhead sprinklers insulates crops such as artichokes from radiation frosts in late autumn. In some orchards wires support fruit trees to lessen breakage of branches by the wind.

Crops germinated directly in the field in late March or April, after the danger of frost is past, still mature a few weeks before similar plants in most other parts of France; and the earlier the produce arrives on the market, the higher the price received by the farmer. The principal development to enhance precocity in addition to the hedgerow has been the spread of manufactured covers to protect crops for all or part of their life cycle. Glass-enclosed forcing frames about two meters long were first adopted in the 1920's. They are placed in the lee of the hedgerow for protection and light. When low temperatures threaten, the frames are covered with straw mats. Seedlings germinated in February or March are ready for transplanting in April or May. Flexible synthetics, however, signaled a revolution in man-made shelters. Plastic materials entered the lower Rhone after 1962 when competing horticulturalists far to the north in Brittany began to produce earlier fruits and vegetables by using them. Cheaper, more malleable, and conserving humidity better than glass, polyethylene film is now an important aid to precocity of crops among many market gardeners in the region.

An elemental technique is to cover the soil with black sheeting to transmit heat to growing crops, to reduce weeds and evaporation from the soil, and to prevent direct contact of fruits and vegetables with the earth. More protective in their function are shelters that provide an artificial environment for the growing plant. These cover 120

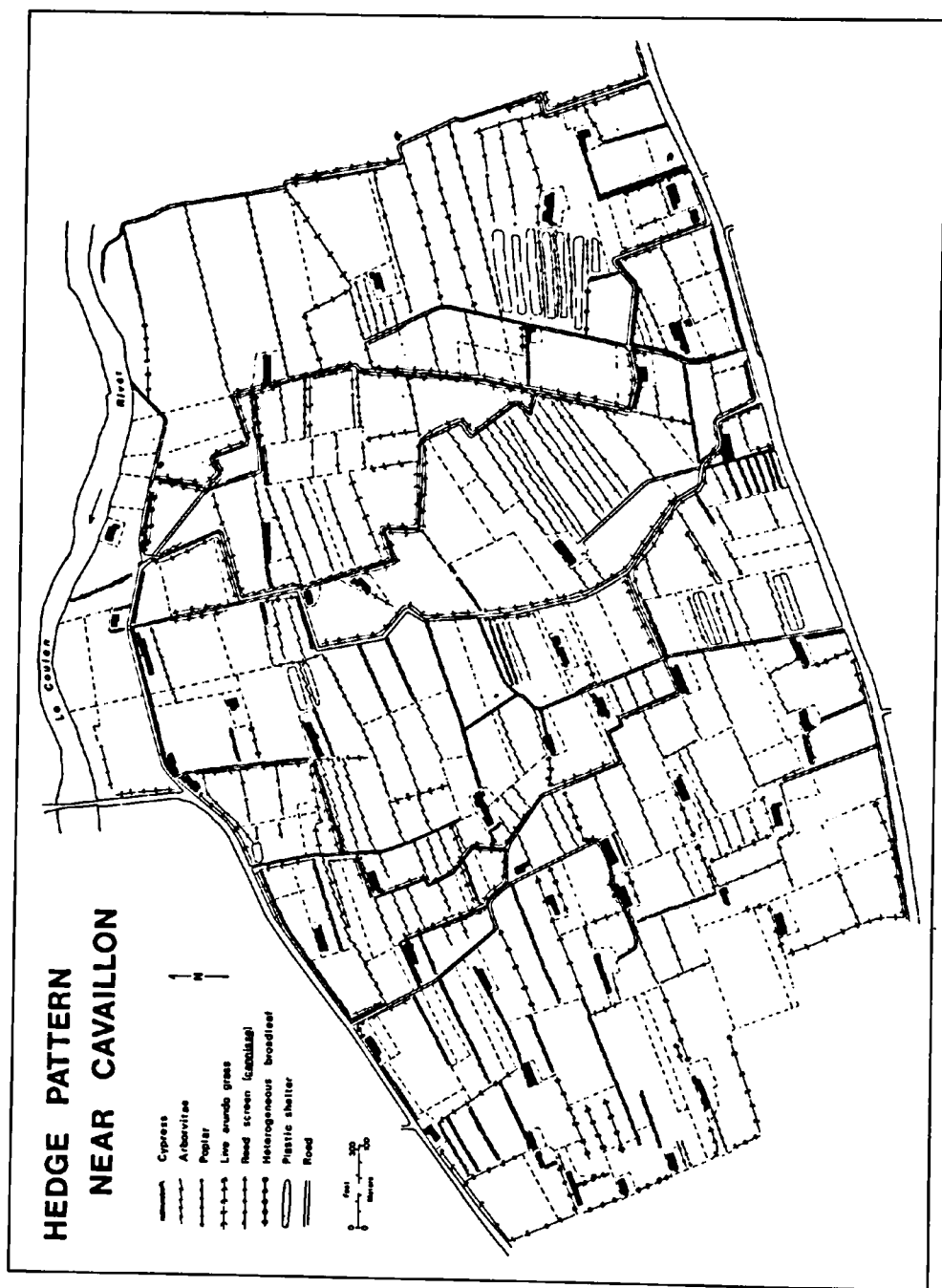


FIG. 6

hectares of land in the Comtat, Crau, and Berre zones.²⁰ Clear plastic "tunnels," five to seven meters long, two meters wide and two and one-half meters high, sheathe young plants germinated there in the late winter or early spring and protect them from frost or desiccation until they are transplanted. More elaborate than the tunnel are heated greenhouses of polyethylene or glass in which crops can mature well ahead of the normal season. Greenhouses require large investments in equipment and fuel, but hothouse strawberries, ready in April, command three times the wholesale price of those grown in the open field that are not ready for market until May or June. Melons grown entirely under shelter are harvested in late May; if transplanted, they become ready in July; but if seeded in the field, they do not mature until August. Part of the agricultural production from field-seeded crops in the lower Rhone is now channeled to the canning industry. In late summer the same fields are readied for planting vegetables to be harvested in autumn.

THE AGGREGATE WINDBREAK LANDSCAPE

More than 150,000 hectares of land in the lower Rhone valley of the departments of Vaucluse and Bouches-du-Rhône can be characterized as a "paysage sous l'emprise du mistral." Wind-control strategies make it one of the most distinctive rural landscapes in Europe. Quickset alignments spaced up to fifty meters apart form the most important component of the composite barrier effect. Actual hedgerow density varies widely even in small areas because of land use differences, access to irrigation water, and personal decisions by individual landowners. The hedgerow pattern varies from a close succession of trees to a series of enclosed rectangles, which assure field parcels protection from winds other than northerly. Live arundo grass or dead cane hedges, neither of which involve a long-term investment in shelter, are often used to supplement defenses on the eastern, western, or southern sides of the field cell. The small fields control the length of the hedgerows: rarely more than 300 meters from end to end, most alignments measure between 100 and 200 meters. The broad orientation of hedgerows is west to east, with many trending to a west-southwest-east-northeast angle. In some cases the cadastral pattern influences the precise direction of the hedgerow.

The regional center of the Rhone hedge lands is on the flat alluvial expanses of the Comtat, east, north, and south of the Durance-Rhone confluence. Within this zone the unusually dense concentration of hedges around Châteaurenard, Noves, St. Rémy de Provence, Cavaillon, l'Isle sur la Sorgue, and Carpentras reflects a strong emphasis on market gardening (Fig. 6). In those places, the closeness of tree alignment—often only twenty meters apart—not only attenuates the negative effects of wind but also magnifies the radiative effects of sun and heat in the lee of the hedge. To some extent the density of hedges is therefore an expression of phenological sensitivity, as market gardeners attempt to assure success in the delicate task of growing primeurs. Dense cypress hedges also inhibit undesirable hybridization between closely related plants. Northward from the Comtat, the hedge landscape covers a part of the Tricastin. In the Crau, windbreaks have been planted in more than half of the area. Small pockets of hedge lands occur east of the Étang de Berre and on the fringe of the Camargue.

²⁰ "Département des Bouches-du-Rhône: Recensement général de l'agriculture 1970-71: inventaires communaux" (Direction départementale de l'agriculture des Bouches-du-Rhône, Marseille, 1972); and "Département de Vaucluse: Recensement général de l'agriculture 1970-71: Analyse des premiers résultats" (Direction départementale de l'agriculture, Avignon, 1972).

Elsewhere in Provence hedgerows are either sporadic or nonexistent. Uplands have not acquired a network of hedges either because the land uses have not required them or because the lack of water has not permitted them. Hedgeless sites include the Alpilles, the Montagnette and other smaller inselbergs, and the pre-Alpine foothills of the Lubéron, St. Christol, Ventoux, and Baronies. The conservative, viticultural district of Châteauneuf-du-Pape north of Avignon has not acquired a hedge landscape. West of the Rhone River in neighboring Languedoc, the postwar replacement of vines by irrigated farming around Nîmes has been accompanied by windbreaks. Thus the geographical imperative is not the presence of intense winds. Rather, the availability of irrigable land enables favorable economic return by intensive use and also provides the moisture necessary for the hedges to grow along with the crops. Although some hedgerows are intercalated in fields of wheat or hay to reduce evaporation, the mass of windbreaks are associated with horticulture.³⁰

Other components of the system of windbreaks in the lower Rhone are barriers that have not been specifically planted to shield growing crops. The abundant arundo grass combs the wind near the ground. Rows of cypress along railroads and highways buffer the mistral to minimize danger to moving vehicles.³¹ Other kinds of vegetation also act, more by accident than by design, as barriers to the wind. Lines of ornamental plane trees (*Platanus* spp.) flank roadsides throughout the Midi. Patches of oak or pine woodland dot the countryside and form additional checks to the wind if fortuitously located. Topographic barriers, many also covered with woods, serve as an apparent, but unverified, wind-control function for the flats at certain exposures. For example, some farmers in the east-west Durance valley assert that the Lubéron upland cuts off the full force of the mistral, one reason claimed for the scarcity of hedges east of Charleval.

Still another component of the sheltered landscape are manufactured devices, none of which has as yet made the hedgerow superfluous. Plastics, although they surpass the microclimatic advantages of hedgerows, actually make the protective function of the latter more important. Without hedges to buffer strong gusts, plastic materials would be shredded or even torn away, and the cost of heating greenhouses would be higher. The large investment in artificial shelters requires that hedgerows be carefully clipped to avoid casting unwanted shade which delays maturation of crops. The arundo screen, which needs no trimming and makes no long-term demands on a particular space, often backs up plastic shelters. Stone or masonry walls, earthen hedgebanks, and farmstead buildings provide additional obstructions to the mistral. The rural dwelling, commonly aligned from east to west, has the facade facing to the south, and the northern side typically has no doors and very few windows. Market gardens are accommodated on the protected side by locating the farmstead some distance back from the road.

Field hedgerows, accessory vegetation, and synthetic shelters form an informally planned windbreak system, the total effect of which operates at a regional level to prevent the mistral from regaining its full force over a large area and exerts a frictional

³⁰ Some of the controversy over the nonhorticultural benefits of hedges is reported by Scipion Gras: Notice sur la Crau et les moyens de la rendre plus productive, *Revue agricole et forestière de Provence*, Vol. 7, 1867, pp. 281-294; M. Labussière: Observations sur le reboisement de la Crau, *ibid.*, Vol. 7, 1867, pp. 313-321; and M. Gueyraud: Des Projets d'amélioration de la Crau d'Arles, *ibid.*, Vol. 8, 1868, pp. 10-20.

³¹ M. Gilles: Plantations du chemin de fer dans la Crau d'Arles, *ibid.*, Vol. 8, 1868, pp. 113-116.

drag in the airflow of the lower layers of the atmosphere that is incorporated into the geostrophic wind.³² The taming of the mistral is estimated to translate into a 40 percent reduction in evapotranspiration when the wind is blowing.³³ The network may also help to check wind erosion of topsoil. Effectiveness of windbreaks would probably increase if continuous shelterbelts were planted at intervals to negate some of the high-speed airflow at the sides of the thousands of short hedgerows.

OUTLOOK FOR THE RHONE VALLEY WINDBREAKS

The survival of an arboreous geometry in this Mediterranean corner depends on a number of factors. Rapid transportation, marketing arrangements of an increasingly international scope, and cheaper labor may foster the importation of fresh fruits and vegetables from Italy, from Spain, from North Africa, or from other places even beyond the Mediterranean that share the characteristic of having more dependable warm weather for early crops. This prospect could eventually make obsolete the orientation to precocious crops in Provence.³⁴ However, if production of primeurs did shift away from the Rhone valley, other crops would still benefit from the wind protection offered by hedges.

On the other hand, if fringe-season crop production in the lower Rhone continues in the long term, new materials, other means of protection from wind and frost, or different perceptions could modify the kind or density of windbreaks. To some extent, genetic engineering can now fit new varieties of plants to the climate. Tougher and less expensive synthetic materials could obviate at least some of the present quickset density. Perforated plastic sheets, vertically mounted on stakes two meters high, that take nothing from the soil have appeared in the region, although their general success is not yet assured. Cost-benefit studies of hedgerows could lead to a reevaluation of current assumptions about their necessity.³⁵ The space, light, moisture, and soil nutrients required by hedges reduce the flat land available for crops in the region by about a fifth. Hedgerows also impede the operation of mechanized equipment and encumber consolidation of property. When high land prices and labor costs are taken into account, the crop damage attributable to the mistral may not justify densely spaced hedgerows of any species because wind above 8 m/s is said to cause some damage to crops regardless of the kind of hedgerow or its spacing.³⁶

Compared to the bocage of the western region of France where, despite many changes, the hedgerow is still the leitmotiv in the countryside, the windbreaks of the Midi are more functional and less enshrined in regional tradition and aesthetics. If and when different land uses are accepted, millions of hedges are likely to be grubbed

³² B. Séguin: Rugosité du paysage et diffusion atmosphérique, *Atmospheric Environment*, Vol. 7, 1973, pp. 429-442.

³³ B. Séguin: Rugosité du paysage et évapotranspiration potentielle à l'échelle régionale, *Agricultural Meteorology*, Vol. 11, 1973, pp. 79-98, reference on p. 95.

³⁴ Fresh green beans are now airlifted to Paris from Africa south of the Sahara (Ginette Pallier: Un Ilot de cultures maraichères en zone soudano-sahélienne: les jardins du lac de Bam en Haute-Volta, *Cahiers d'Outre-Mer*, Vol. 28, 1975, pp. 252-274).

³⁵ In the early decades of this century, conventional wisdom proscribed horticulture from the plain around Valence because of the ferocity of the northerly winds; today peach orchards occupy this same area without any protective hedges (Pierre Dubesset: Choix agricoles et caractères du climat dans la région du Rhône moyen, *Revue de géographie de Lyon*, Vol. 47, 1972, pp. 297-326).

³⁶ P. de Boixo: De la Protection des cultures contre les dégâts du vent, *Comptes rendus hebdomadaires des séances de l'Académie de l'agriculture de France*, Vol. 46, 1960, pp. 585-597, reference on p. 595.

out with little regret. The rapid acceptance of vegetative barriers in the last century and the shift from Mediterranean cypress to poplar in this century suggest that horticulturalists in the Rhone are adept at learning to fill their needs.

Somewhat over a century ago George Perkins Marsh remarked that protective belts of trees on the stark plain of the Crau enabled fruit trees and vegetables to thrive in what "had remained a naked waste from the earliest ages of history."³⁷ To ascribe the development of the Rhone hedge lands to the simple discovery of their micro-meteorological advantage is misleading, for without innovations in irrigation, transportation, and marketing it could not have emerged. Similarly, the large amounts of capital and labor needed for intensive horticultural production were economically validated by a predilection for fresh produce in prosperous European cities. Further mutations of the windbreak landscape in the years ahead, however, may be determined by more than the discovery of the aerodynamically ideal windbreak. Agriculture is slowly receding as irrigated farmland in the lower Rhone valley is increasingly turned to suburban and industrial uses.

³⁷ George P. Marsh: *The Earth as Modified by Human Action: A New Edition of Man and Nature* (Charles Scribner, New York, 1874), p. 162.

EASTER ISLAND: THE SCOTTISH CONNECTION*

J. DOUGLAS PORTEOUS

SCHOLARLY work on Easter Island has been concerned almost wholly with ethnological and archaeological problems.¹ In particular, much effort has been devoted to elucidating the provenance, age, meaning, and cultural significance of the famed statues, the *rongo-rongo* script, and other unique artifacts.² Although some attempts have been made to ascertain the lineaments of Easter Island prehistory (before 1722) and protohistory (1722-1864, the period of European exploration), work on the historical modernization and development of the island is almost completely lacking.³ Yet Easter Island's historical geography demands attention, for its development since the 1860's, largely the work of European entrepreneurs, broadly reflects the development of Oceania as a whole. The island differs, however, from most of Oceania in that its precise mode of exploitation during the last hundred years was directed not by plantation owners, miners, or traders but by the enterprise of two successive Scottish sheep-rearing companies.

From the late 1860's Easter Island was under the economic control of the Brander-Bornier partnership, a sheep-rearing concern based in Tahiti. In the 1880's entrepreneurial power passed to E. Merlet and Company of Valparaiso, Chile, a weak organization that was soon absorbed by Williamson, Balfour and Company, an early Scottish multinational corporation with branches throughout Latin America.

My aim in this paper is to trace the role of these companies in the transformation of Easter Island after the 1860's. I consider transformation in terms of sociopolitical structure, economy, and landscape. Before these developmental changes can be explored, however, the context in which they took place must be outlined.

THE CONTEXT OF CHANGE

Until the 1860's Easter Island suffered only brief, though often violent, encounters with European exploratory vessels. At that time, Oceania was being scoured for kanaka labor to work in the mines and plantations of the Pacific rim. Being the closest inhabited Polynesian island to Peru, albeit more than 2,000 miles from the South

* Research funds for a comprehensive study of Easter Island modernization were gratefully received from the Canada Council, the International Development Research Centre (Ottawa), and the University of Victoria.

¹ The most comprehensive reviews of these areas are to be found in Thor Heyerdahl and Edwin N. Ferdon, eds.: *Archaeology of Easter Island*, *School of Amer. Research and Museum of New Mexico Monograph No. 24*, Santa Fe, 1961; and Alfred Métraux: *Ethnology of Easter Island*, *Bernice P. Bishop Museum Bull. 160*, Honolulu, 1971.

² Popular works on these subjects are legion. Scholarly works include: W. S. Ayres: *The Cultural Context of Easter Island Religious Structures* (unpublished Ph.D. dissertation, Dept. of Anthropology, Tulane Univ., New Orleans, La., 1973); P. Sebastian Englert: *La tierra de Hotu Matu'a: historia, etnología y lengua de la Isla de Pascua* (Editorial San Francisco, Padre Las Casas, Chile, 1948); and Thor Heyerdahl: *The Art of Easter Island* (Allen & Unwin, London, 1975).

³ Prehistory is discussed by Englert, *op. cit.* (see footnote 2 above); and P. C. McCoy: *Easter Island Settlement Patterns in the Late Prehistoric and Proto-historic Periods* (unpublished Ph.D. dissertation, Dept. of Anthropology, Washington State Univ., Seattle, 1973). A legal and administrative history to the 1930's is found in Victor M. Vergara de la P.: *La Isla de Pascua: dominación y dominio* (Memoria de Prueba, Facultad de Ciencias Jurídicas y Sociales de la Universidad de Chile, Santiago, 1939).

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American coast, Easter Island was regarded as a labor reservoir by Peruvian entrepreneurs. From 1859 to 1862 approximately a thousand islanders were inveigled or forced into leaving their island for the plantations, guano mines, and cities of coastal Peru. Transportation, emigration, and introduced disease rapidly reduced the native



FIG. 1.—Hangaroa village, Easter Island, 1974, from the south. This is the only extensively treed area on the island.

population from about three or four thousand in the early nineteenth century to fewer than two hundred in the 1870's.⁴

By this time the island had become a *tabula rasa*, to be occupied without hindrance by any determined entrepreneur. Accordingly, Jean-Baptiste Onexime Dutrou-Bornier, in partnership with the Branders, a Tahiti-based Scottish merchant family, settled on Easter Island in 1868. In the next half decade Bornier acquired title to much of the land surface of the island in exchange for small quantities of cloth. Several missionaries, who had occupied the island since the mid-1860's, were compelled to return to Tahiti and Chile in 1871 because of Bornier's intransigence. When Bornier was murdered by the indigenes in 1876, the Brander-Bornier partnership dissolved in a lengthy lawsuit involving a complex series of statements, depositions, appeals, and counter appeals that took place in Papeete, Tahiti, Bordeaux, France, and Anstruther, Scotland, to which town in the county of Fife the Darsie branch of the Brander family had returned in the 1880's.⁵

Until the lawsuit was resolved in 1893, the Branders retained effective control of

⁴ Métraux, *op. cit.* [see footnote 1 above], pp. 20–23.

⁵ Details of this litigation are preserved in an archive entitled "Documentos de la Isla de Pascua Pertencientes al Señor Enrique Merlet," currently located at the Compañía de Inversiones "La Escocesa" Ltda., Santiago, Chile [hereafter referred to as Documentos archive].

Easter Island, although *de jure* sovereignty was claimed by the Republic of Chile in 1888. The Chilean government, however, at first owned none of the island's real estate and then was able to purchase only about two thousand hectares in the Hangaraoa area (Figs. 1 and 2). The Branders sold the bulk of the island's land surface to a group

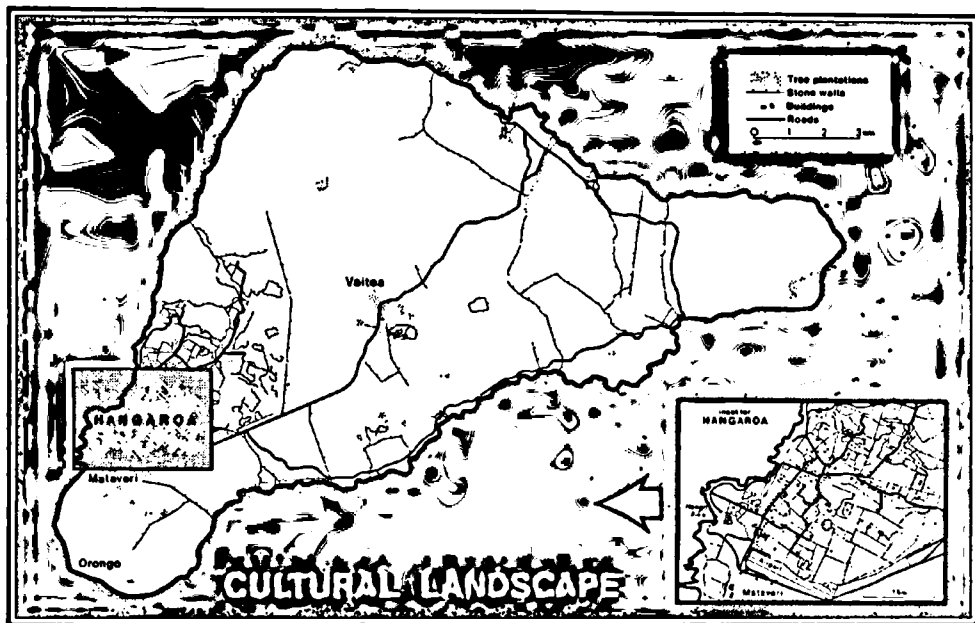


FIG. 2—Elements introduced by Europeans into the Easter Island cultural landscape, 1868–1952.

of fellow Scottish entrepreneurs based in Chile. Having made a vain attempt to settle its property on the island with mainland *colonos* between 1888 and 1892, the Chilean government decided that the most economical method of developing an island more than 2,000 miles from its coast was to permit a private business to exploit and maintain the island at its own cost. Accordingly, the government-owned area was leased to the business firm that owned the main part of the island.

The Valparaíso-based mercantile firm of Williamson, Balfour, whose principals came from Anstruther and environs, took control of Easter Island in the mid-1890's.⁶ Originally operating through the firm of Merlet and Company, Williamson, Balfour created a subsidiary specifically to work Easter Island. La Compañía Explotadora de la Isla de Pascua (CEDIP, or Easter Island Exploitation Company) was constituted in 1903 for the purpose of pursuing the Easter Island wool trade. CEDIP retained control of the island until 1952, when the Chilean government finally asserted its sovereignty in the shape of occupation by the Chilean navy.

For almost a century, therefore, Easter Island existed as a company state, which is defined as a functional region dominated economically, socially, and politically by a

⁶ The official history of the Williamson, Balfour company is recounted in Wallis Hunt: *Heirs of Great Adventure: The History of Balfour, Williamson and Company Limited* (2 vols.; Balfour, Williamson & Co. Ltd., London, 1951 and 1960). Williamson, Balfour was the Chilean subsidiary of the Liverpool firm of Balfour, Williamson.

business corporation rather than by a civil government.⁷ The policies initiated by the Brander in the 1860's were carried on by CEDIP until the 1950's, for the economic goals of both companies with respect to the development of Easter Island were remarkably similar.

By 1871, the Easter Island natives had been reduced to approximately one-thirtieth of their former number, and with the departure of the short-lived Catholic mission, the island was free for economic exploitation. Arid, almost treeless, grass-covered, and with a cool subtropical climate, strong winds, and unpredictable precipitation, Easter Island was clearly less suited to plantation crops than to pastoralism. It thus resembled parts of the Hawaiian islands of Hawaii and Niihau, the latter of which was being developed contemporaneously by another Scottish pastoral concern.⁸

The goal of the Brander-Bornier partnership was clearly stated, in 1871, to be "the exploitation of Easter Island, known also as Rapanui, for the raising of sheep and other animals, commerce in wool and generally in all the products of the said island which are suitable for export."⁹ The chief products leaving Easter Island in Brander vessels in the 1880's were wool, hides and skins, bones, tallow, horsehair, and some live beasts. Cattle and sheep, introduced by the missionaries, were vastly increased in numbers by the Brander-Bornier restocking campaign. Imported horses became the chief mode of transportation.

The goal of making Easter Island a wool-producing estate was in no way altered by the change of ownership. In 1903 CEDIP stated its objectives as being "to acquire the privately owned land on Easter Island, acquire or rent the state-owned land on the said island, to exploit them both, to obtain new boats and acquire any other materials necessary for the furthering of development."¹⁰ Indeed, under CEDIP the cattle trade was reduced in importance and the sheep were gradually increased to approximately 40,000, a flock that produced 70 to 100 tons of fine wool a year from the 1920's until the 1950's.

Brander and Bornier had introduced Australian sheep into Easter Island by way of Tahiti. CEDIP was based in Chile. Thus the two major diffusion paths of Scottish pastoralism, via Australia and southern South America, met on Easter Island in the late nineteenth century. Between 1868 and 1952 these Scottish entrepreneurs transformed the island from a traditional Polynesian subsistence economy to a commercial, wool-producing ranch. In doing so they re-created the polity, social system, economy, and cultural landscape of a nineteenth-century Scottish estate.

THE IDEOLOGY OF IMPROVEMENT

To appreciate fully the transformation of Easter Island after 1868 it is necessary to trace the cultural origins of the entrepreneurs and their island managers. The Brander, the Darsies, and the CEDIP partners were all from eastern or southern Scotland. Many of the managers of the Easter Island estate, boasting such surnames as Edmunds, Harris, Clark, Sanders, Munro, Morrison, McKinnon, and Murdoch

⁷ J. Douglas Porteous: *The Company State, a Chilean Case-Study*, *Canadian Geogr.*, Vol. 17, 1973, pp. 113-126.

⁸ Douglas L. Oliver: *The Pacific Islands* (Doubleday and Company, Inc., Garden City, N.Y., 1961), p. 280.

⁹ "Acte de Société Brander Dutrou-Bornier, 30 October 1871, extracted from the minutes of M. Gustave Vincent, notary, of Papeete, Ile Tahiti," Documentos archive. My translation.

¹⁰ "Estatutos de la Compañía Explotadora de la Isla de Pascua," Documentos archive. My translation.

Smith, came either directly from the Lowlands of Scotland or from the Scottish sheep-rearing operations in Patagonia, Tierra del Fuego, Australia, or New Zealand.

The impact of a newly established commercial wool economy on traditional subsistence societies has been well documented in Great Britain.¹¹ In England, during the Tudor period, the establishment of sheep rearing involved enclosures, population clearances, deserted villages, and the forced migration and proletarianization of many peasants. Similar changes came to Scotland only after the defeat of the clans in 1745 but were sufficient to aid in the destruction of the culture of the tribal Gael. By 1800 Lowlander sheepmasters were established in almost all of the former clan lands south of the Great Glen. Expansion progressed northward, and sheep-related "improvements" continued into the middle of the nineteenth century, almost contemporaneously with the introduction of sheep into Easter Island.

Sheep rearing is capital intensive; labor demands are low. In Scotland, the change from tribal mixed crop and animal husbandry to a commercial pastoral monoculture after 1745 meant that any former occupants of the land became landless and redundant. Voluntary emigration was followed by the Clearances, whereby large numbers of clansmen were forcibly removed from their ancestral lands and compelled to emigrate or to endure resettlement in specially built coastal villages. The few who were retained were employed as shepherds, maintenance workers, or crofters who cultivated small properties in a quasi-communal semisubsistence fashion and occasionally worked for wages on the estate that had replaced the former clan territory.¹² The authority of the clan chieftain was replaced by that of the alien or alienated laird, usually an absentee landlord represented locally by a managing factor. In this way the personal links between chief and clansman were broken, and the remaining population became wage earners or peripheral subsistence agriculturalists and fishermen.

The sheepmasters radically reorganized the former clan agricultural lands, the process being generally known as "improvement." Physical improvements to the land included the erection of walled enclosures to facilitate pastoral rotation and the construction of shepherds' huts, paddocks, feeding stations, shelterbelts, piers, and roads. Sheep rearing not only denuded the Highlands of people but also increased the loss of timber. Sheep are partial to tree bark and young shoots; thus they kill trees and effectively prevent arboreal regeneration.

One of the few landlords to inveigh against the wholesale transformation of Highland life and landscape wrote: "Nothing can be more detrimental. The first thing is to drive away all the present inhabitants. The next is to introduce a shepherd and a few dogs; and then to cover the mountains with flocks of wild, coarse-woolled, and savage animals which seldom see their shepherd or are benefited by his care."¹³ This succinct description of the initiation of sheep ranching in eighteenth-century

¹¹ D. Mills and M. L. Parry: *A Scottish Agricultural Revolution?* *Area*, Vol. 8, 1976, pp. 237-239; John Prebble: *The Highland Clearances* (Penguin Books, Harmondsworth, Middlesex, 1969); J. Walker: *An Economical History of the Hebrides and Highlands of Scotland* (Edinburgh, 1812); and A. J. Youngson: *After the Forty-five: The Economic Impact on the Scottish Highlands* (Edinburgh Univ. Press, Edinburgh, 1973).

¹² For a discussion of crofting, improvement, and estates on one Hebridean island whose landscape and history show some parallels with Easter Island, see J. D. Porteous: *The Island Parish of Jura*, *Scottish Geogr. Mag.*, Vol. 84, 1968, pp. 56-65; and Harald Uhlig: *Die ländliche Kulturlandschaft der Hebriden und der westschottischen Hochlande*, *Erdkunde*, Vol. 13, 1959, pp. 22-46.

¹³ Walker, *op. cit.* [see footnote 11 above], p. 407.

Scotland applies just as well to nineteenth-century Easter Island. Sheep-induced changes on the latter are conveniently considered in terms of sociopolitical, economic, and landscape transformations.

SOCIOPOLITICAL CHANGE

Two major actions, accomplished in the Brander era, were at the root of social change in Easter Island after the 1860's. Brander and Bornier, free of the missionaries after 1871, were able to institute a process of population clearance designed to turn over the bulk of the island to sheep. Of the several hundred islanders who remained after the slaving and disease of the early 1860's, at least 170 were transported to Tahiti to work on the Brander plantations. Another 150 were distributed among the islands of the Gambier archipelago.¹⁴ Fewer than 200 remained on Easter Island. Having rid the island of most of its inhabitants, the Brander enterprise was keen to control the movements of the remainder. The sheepmasters, anxious to allow their sheep unrestricted freedom to range the island, fearful of the depredations likely to be made on the animals by hungry natives, and wishing to have the small population under close supervision and within easy reach when employment needs arose, rounded up the native population and forced them to live in the government-owned area of Hangaroa, close to the CEDIP manager's house at Mataverí. In John Brander's words, "The Rapanui were and have been forbidden to disturb the stock and they were compelled to live in the village of Hangaroa and for convenience sake allowed to live in a certain part of Mataverí."¹⁵

This relocation probably occurred in the 1880's, when both Brander and his relative, the half-Tahitian Salmon, lived on Easter Island. It was most convenient for the sheepmasters to divide the island neatly into two sections: a small, fertile, government-owned native reserve in Hangaroa, under CEDIP control by lease agreement; and the remainder of the island, CEDIP-owned and organized as a sheep ranch from the Mataverí ranch house. To the company that followed the Branders, Easter Island thus became a personal estate, with its spreading emparked pastures, its great house at Mataverí, and the village of Hangaroa beyond its gates (Fig. 3).

Bornier's choice of Mataverí for the company ranch house was a masterstroke, indicating awareness of the psychological relationship between place and people. Mataverí had been a traditional gathering place for intertribal festivities associated with the annual cult activities at the nearby ceremonial center of Orongo. This cult appears to have died out between 1866 and 1878, precisely the era of the Brander-Bornier partnership. Missionary influence was partly responsible for the demise of the cult, but Routledge suggests that the Mataverí-Orongo ceremonies were "finally crushed by the secular exploiters of the island, whose house at Mataverí rests on the foundation stones of the cannibal habitation."¹⁶ Like the early Christian fathers who deliberately erected churches on pagan religious sites and absorbed heathen rites into sacred liturgy, Bornier showed great insight in placing the farmhouse on top of the stone foundation blocks of native houses at Easter Island's only island-wide ceremonial site (Fig. 4). By substituting the farmhouse for cult buildings and the annual

¹⁴ Métraux, *op. cit.* [see footnote 1 above], pp. 22-23.

¹⁵ Letter from John Brander to Schlubach, 1897, in Documentos archive.

¹⁶ Mrs. Scoresby Routledge: *The Mystery of Easter Island: The Story of an Expedition* (Sifton, Praed, London, 1919), p. 137.

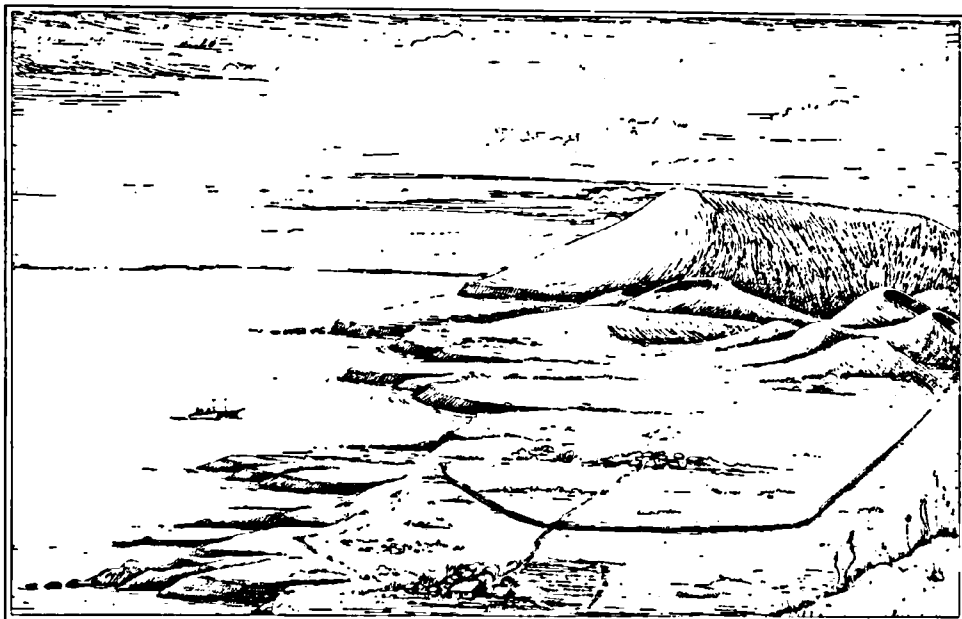


FIG. 3—Mataverí (company headquarters, foreground) and Hangarua (native village, middle ground) at the time of World War I. The wall around Hangarua is clearly visible. Redrawn by Ole J. Heggen from Routledge, *op. cit.* [see text footnote 16].

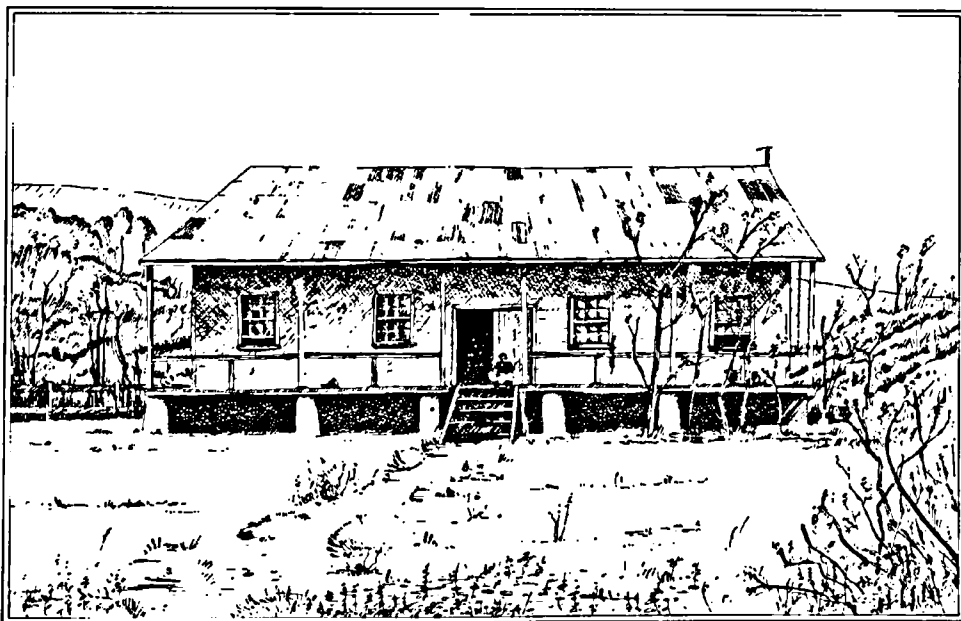


FIG. 4—The ranch manager's house, Mataverí, about 1914. The foundation stones are from old native houses. Redrawn by Ole J. Heggen from Routledge, *op. cit.* [see text footnote 16].

shearing festivities for the Mataveri-Orongo ceremonies he effectively replaced a sacred religion by the trappings of a secular, commercial counterpart.

Indeed, the factors who inhabited the Mataveri ranch house from the 1860's until 1952 were in effect subchieftains, carrying out the orders of an absentee laird. In turn, the indigenes took on the role of crofters, mainly engaged in subsistence agriculture in the Hangaroa area but always available to be called on as laborers when the needs of the estate demanded. Wage labor for the company was the only official means of obtaining meat and hard cash, although the latter generally returned to the company store in exchange for processed foods imported by the company, whose vessel called once a year to take off the wool clip.

ECONOMIC TRANSFORMATION

With its rolling landscape, its conical hills, its abundance of stone, its grassy uplands, its lack of tree cover, and the proximity of the sea, Easter Island resembled a Hebridean landscape. Into this landscape the Brander and their associates had introduced 14,000 sheep, 720 cattle, and 150 horses by 1887.¹⁷ The number of sheep rose to 24,000 by 1920.¹⁸ Determined improvements by CEDIP in the 1920's raised this figure to 41,412 by 1943.¹⁹ By making its infrastructural and stock improvements CEDIP had followed not only the recommendations of W. A. Bryan, a Hawaiian agriculturalist who prepared a development plan in 1920, but also the advice of John Brander, who in 1887 had accurately prophesied: "Pay a great deal of attention to the sheep and I believe that the island could produce from sixty to one hundred tons [of] wool per annum in time."²⁰

Very few indigenes were permanently employed by CEDIP. In 1920 the company employed only three native workers, a mechanic, a watchman, and a shepherd.²¹ As the sheep flock grew, however, several more shepherds and company police were hired from among the native population of Hangaroa. Rarely more than a dozen in total, these permanent employees were supervised by only two Europeans, a manager who lived at Mataveri and an assistant manager who divided his time between Mataveri and the ranch's farm at Vaitea in the center of the island.

A typical annual economic cycle developed, which remained essentially unchanged from the 1890's to the second half of the twentieth century. The company manager made calls for labor at set intervals, thus providing the indigenes, who subsisted as fishermen and agriculturalists working garden plots around Hangaroa, with a temporary cash income.²² Twenty or more men were required for gelding bullocks, an annual operation that lasted a week. Three weeks were required for rounding up the half-wild horse population, gelding the males, and cutting horsehair for export. Sheep-related activities, however, provided most of the temporary employment. Dipping required the assistance of at least twenty indigenes for one week every three months. The annual shearing involved the bulk of the native population and was

¹⁷ Letters from John Brander to Policarpo Toro, 1887, in Vergara, *op. cit.* [see footnote 3 above], Appendixes III and IV.

¹⁸ William Alanson Bryan: Report on the Water Supply and Possible Agricultural and General Development of the Island of Pascua (unpublished report, 1920, in Documentos archive).

¹⁹ "Datos sobre la Isla de Pascua," *Geochile*, Vol. 1, 1951, pp. 13-14.

²⁰ Brander, letters to Toro [see footnote 17 above].

²¹ R. P. Bienvenido de Estella: Los misterios de la Isla de Pascua (Editorial Cervantes, Santiago, Chile, 1920), pp. 185-186.

²² *Ibid.*, p. 185.

the only time that most of these people were able to leave the Hangaroa area. Shearing took place at Vaitea, to which central point the island's sheep were herded by native horsemen. The actual shearing process, which lasted for about two weeks, involved a large but variable proportion of the able-bodied native population. Women and children were extensively employed to help the shearers, to glean loose wool, and to assist in the baling of the raw wool. Finally, about twenty men were employed to haul the bales in bullock carts to the quay at Hanga Piko, near Mataveru. Then the wool was transferred to the company ship by small boats. After World War II rafts made from wooden poles and oil drums were used to lighter cargo (Fig. 5), until they were replaced by landing craft in the 1970's.

This rather irregular demand for labor was well suited to the Polynesian temperament; a CEDIP consultant stated in 1920 that "the tendency to work furiously for a while, followed by long periods of rest, eating, song, and sleeping, graphically describes [the Easter Islanders'] day. They are therefore best adapted to piecework, or as extra hands when rush work is to be done as loading cargo, wool shearing etc."²³ If commercial plantations had been introduced on any large scale it is likely, as in Hawaii, that the importation of labor would have been necessary.²⁴ As the island remained devoted to sheep, CEDIP found it convenient to pay its native workers in kind as well as in cash. During periods of intense work activity, mutton became an important supplement to the normal native diet of fish and vegetable products.

LANDSCAPE TRANSFORMATION

The demands of sheep rearing on the landscape were few. Basic infrastructural needs were satisfied by the creation of a pier at Hanga Piko, rough roads, wells, and a few huts for native shepherds (Fig. 6). Because the dominant vegetation cover was already a grassland association, capable of supporting more than twice the density of sheep possible in Patagonia, the companies did not consider it necessary to introduce new grass species on a scale that would radically change the existing association. They did make a considerable effort, however, to rid the pasturage of the coarsest grasses. This was accomplished by a program of selective burning, as practiced in Scotland, Patagonia, and elsewhere. The introduction of sheep reconfirmed the dominance of grasses, for young tree shoots were readily eaten and larger trees were stripped of bark. Several visitors to Easter Island after the 1860's noted the rapid demise of the scanty indigenous tree cover because of sheep depredations. In particular, the endemic *Sophora toromiro* tree, now extinct, was found in the 1880's to exist "in considerable numbers," but "all, or nearly all, dead and decaying by reason of their being stripped of their bark by the flocks of sheep which roam at will over the island."²⁵

As if in response to the destruction of the indigenous tree cover by their flocks, the alien sheepmasters played their "improving landlord" role by introducing a variety of alien trees. The most significant of these were Australian eucalypts which shed their bark rather than their leaves, thus providing continuous shade for the sheep while

²³ Bryan, *op. cit.* [see footnote 18 above].

²⁴ From the 1880's until the 1950's, Chilean visionaries put forward elaborate plans for the development of banana, sugar, coffee, and other plantations on Easter Island. Not one of these came to fruition.

²⁵ G. H. Cooke: *Te Pito Te Henua, U.S. Natl. Museum Rept.*, 1899, p. 705. See also J. L. Palmer: Davis or Easter Island, *Proc. Liverpool Literary and Philosophical Soc.*, Vol. 29, 1875, pp. 275-297; and Heyerdahl and Ferdon, *op. cit.* [see footnote 1 above], pp. 493-526.



FIG. 5—Rafts used to lighter goods between Hanga Piko quay and ocean-going vessels anchored offshore. Constructed from wooden poles and oil drums, these rafts were used into the early 1970's.



FIG. 6—Landscape between Rano Raraku (the statue quarry) and Tongariki, showing pasturage, roads, walls, paddocks, shelterbelts, and a shepherd's cabin.

being less susceptible to damage. The fast-growing eucalypts are useful as timber and valuable as windbreaks. The wood was not suitable for carving artifacts, so the eucalypts were safe from the depredations of the indigenous population. The clumping of these trees on Easter Island, and their arrangement in lines as windbreak screens, is reminiscent of the new farms and emparked estates created by gardenists and agriculturalists in eighteenth-century Great Britain.

Sheep rearing demanded not only different types and patterns of trees but also a new landscape feature, the fence. The indigenes did not normally erect fences or walls, but when they were compelled to build them because of the attacks of sheep on agricultural plots, their garden enclosures were irregular and tended toward curvilinearity (Fig. 2). In sharp contrast, the large-scale fencing of Easter Island, accomplished primarily by Scottish ranch managers, involved laying out long, straight stone walls, product of the Europeans' linear, carpentered world.²⁶ Easter Island's dry stone walls resemble those of other stony regions, but rarely do these *piras* approach the quality of the traditional dry stone walling in Highland Britain. Many show signs of hasty erection, with ill-fitting stones and inaccurate keying. Moreover, the shecpinasters did not hesitate to use stones that would now be regarded as important archaeological artifacts. Ceremonial platforms were incorporated into the wall pattern, and the curbstones of traditional Polynesian houses were found particularly useful. Alfred Métraux, writing of a former native village, remarked: "There are the remains of several houses, though some have been pulled down by Williamson-Balfour agents for stones to build their walls."²⁷ The stone houses of the unique ceremonial village of Orongo were systematically pillaged for their slatelike slabs, which were carried away by the cartload to the later frustration of archaeologists.²⁸

The walls were built to divide the island into manageable sectors to facilitate the process of "camp rotation," whereby animals were moved from enclosure to enclosure. The process improved pasturage quality, permitted controlled breeding, and facilitated dipping, shearing, rounding up, and other activities. The most essential wall on the island, at least from the company's point of view, was the long boundary wall which symbolically cut off the island's single village of Hangaroa from the sheep pastures that comprised the bulk of the island (Fig. 3). By this means CEDIP attempted to separate the native population from the sheep stock. This *ad hoc* reservation system was only partially effective, however, for the wall was patrolled mainly by company police of indigenous origin. Sheep rustling for food soon became an established characteristic of the Easter Island indigene's life-style.

AFTER THE SCOTS

The exploitation of Easter Island as a wool-producing commercial enterprise for almost a century resulted in its complete transformation. The development of the island after 1860, with population clearances, emigration, and forced resettlement, with the creation of a semisubsistence labor pool, with the rule of alien company managers on behalf of absentee landlords, with the stocking with sheep of former agricultural lands, and with the burning, walling, planting, and general "improving"

²⁶ Yi-Fu Tuan: *Topophilia* (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1974).

²⁷ Métraux, *op. cit.* [see footnote 1 above], p. 129.

²⁸ William Mulloy: *Investigation and Restoration of the Ceremonial Center of Orongo, Easter Island* (Easter Island Committee, International Fund for Monuments Inc., New York, 1975).

of the landscape, closely parallels the experience of Highland Scotland after 1745. The economy, sociopolitical organization, and cultural landscape of the island were made over by its Scottish masters to resemble a contemporary Scottish estate.

Throughout the early part of the twentieth century the island was almost totally neglected by the Chilean government. Indeed, the office of *subdelegado marítimo*, the chief government official on the island, was frequently held by the CEDIP manager. Stories of repression and abuse of the indigenes by CEDIP, however, became a permanent feature of the Chilean press and eventually resulted in government action. But the assumption of control by the Chilean navy in 1952 produced little change, for the island continued as a sheep ranch and, from the islanders' point of view, the naval contingent simply replaced the CEDIP manager as alien ruler.

The importance of sheep rearing gradually declined under naval rule and became almost irrelevant after overwhelming social and economic changes were inaugurated in the late 1960's. Under the Frei government, Hanga-roa was given municipal status in 1967, and for the first time Easter Islanders were allowed to vote in elections at all levels.²⁹ In the same year, an airport was opened at Mataverí and scheduled flights were inaugurated between Chile, Easter Island, and Tahiti. A United States contingent arrived to man a satellite tracking station, and a large number of Chilean officials were brought in to operate government agencies. With this massive injection of modernizing influences, the indigenes began to abandon their agricultural plots to take up paid employment or to provide accommodation and transportation for the growing number of tourists.

In this new milieu, the pastoral hinterland of Hanga-roa is regarded less as sheep-rearing country than as the archaeologically rich basis for a thriving tourist industry. With the employment of indigenes in hotels and government installations the patterns of life laid down by the Scottish entrepreneurs are now undergoing inexorable change. Yet the pastoral landscape of walls, paddocks, tree clumps, and plantations, the chief legacy of the Scottish entrepreneurs, is likely to endure as a protected landscape under the aegis of the Chilean national parks agency.

²⁹ Naval control was reimposed after the Chilean coup of 1973.

ENVIRONMENTAL RISK FACTORS OF CALIFORNIA ENCEPHALITIS IN MAN*

GERALD F. PYLE and ROBERT M. COOK

THE occurrence of encephalitis in humans is caused by several different kinds of arthropod-borne viruses and a variety of other complications resulting from either head injury or such infectious childhood diseases as mumps, measles, or chicken pox. Each year encephalitis affects hundreds of young children and a lesser number of adults in the United States. Generally explained as "inflammation of the brain," not all cases of encephalitis are severe and few persons die from the disease. However, such serious aftereffects as retardation, paralysis, or mental instability present a major problem. Signs and symptoms of encephalitis in humans include a progressive and rapid syndrome that may or may not comprise headache, nausea, vomiting, fever, sore throat, chills, stiff neck, drowsiness, trembling, vertigo, convulsions, and coma, sometimes followed by death. No vaccine for immunization against encephalitis exists. The best measure taken at this time is treatment with antibiotics after infection.

The spatial distributions of postinfectious and other kinds of encephalitis not caused by viruses are difficult to ascertain and may be random fluctuations of population density. Conversely, arthropod-borne encephalitis viruses can be associated with specific nonrandom environmental risk factors. Knowledge of the environmental elements that contribute to the proliferation of mosquitoes and the chance of diffusion of encephalitis viruses among humans and animals can be used in disease prevention.

Geographically, arthropod-borne encephalitis does not occur in endemic or pandemic waves as do cholera and influenza. In a fashion similar to malaria, encephalitis is characterized by localized outbreaks often emanating from endemic source areas.¹ This aspect of encephalitis outbreaks has influenced the system for classifying the disease. Four major types of arthropod-borne encephalitis, thought by many to be interrelated groups or "strains," are recognized in the United States. For purposes of nationwide reporting the National Center for Disease Control uses the following categories: Eastern, Western, St. Louis, and California. Reasons for a degree of uncertainty regarding specific classes include the isolated nature of outbreaks, the types of mosquitoes identified by laboratory tests as carriers, the differences in viruses, and the frequent use of local geographical names in labeling kinds of arboviruses. For example, California encephalitis has been attributed to *Aedes dorsalis* and *Culex tarsalis* carriers in the western United States, while the well-known La Crosse strain of Wisconsin and California encephalitis in Ohio have both been traced to *Aedes*

* This study was supported by a grant from the University of Akron Research (Faculty Projects) Committee. Our research would not have been possible without the thoughtful cooperation and access to epidemiological reports offered by Drs. Thomas Halprin, Margaret A. Parsons, and Richard L. Berry of the Communicable Disease and Laboratory Division of the Ohio Department of Health. We also extend our appreciation to Martin Knapp, Victoria Hosler, and Judith Sherman for organizational assistance.

¹ Max Theiler and W. G. Downs: *The Arthropod-borne Viruses of Vertebrates* (Yale Univ. Press, New Haven, Conn., 1973), pp. 209-262.

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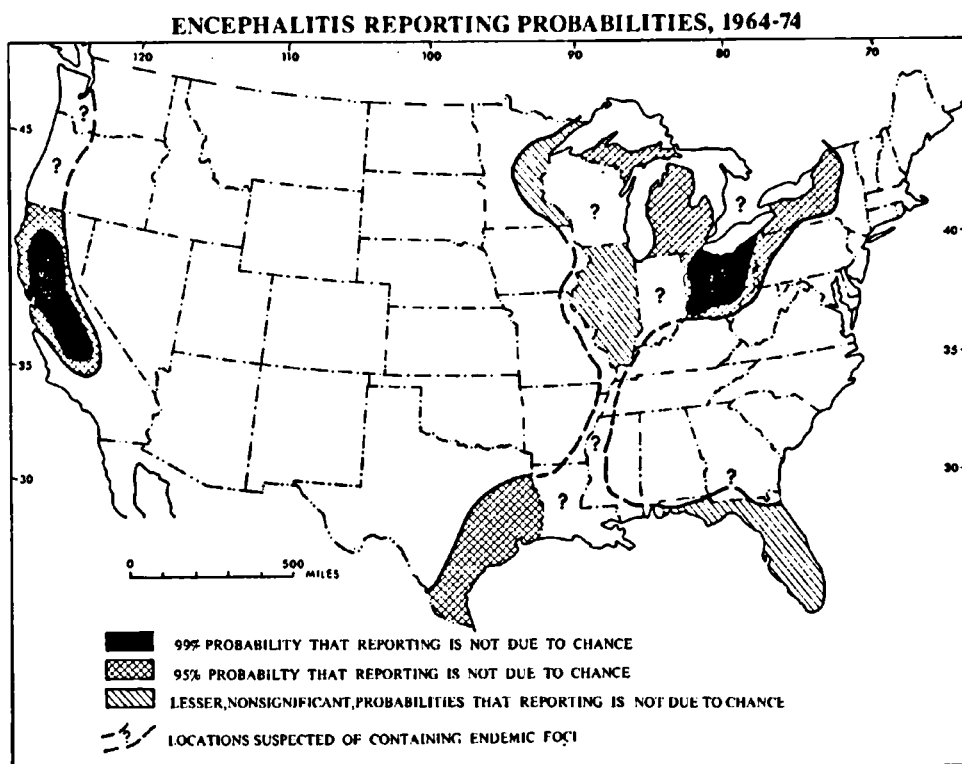


FIG. 1.—Probabilities that reporting of encephalitis in the United States between 1964 and 1974 is not due to chance.

triseriatus.² When arboviruses are specifically identified, California encephalitis virus is more commonly reported than the other three general groups.

Thus, similar strains of encephalitis viruses have different local names, and viruses named for specific locations (usually where they are initially identified) are by no means restricted in their geographical distribution to those places. The purpose of this study is to analyze spatial and temporal distributions of California encephalitis in Ohio, where it is now known to be endemic, so that natural environmental risk factors can be better understood. Analytical techniques used in medical geography have been applied with this goal in mind.

BIOGEOGRAPHICAL CHRONOLOGY

The discovery of the virus that causes California encephalitis is an example of traditional methodology in tropical medicine. Procedures involved the establishment of laboratories and clinics in locations known to be potentially hazardous, followed by attempts to identify disease-causing phenomena. The first successful attempt was reported in 1952 by William McD. Hammon, William C. Reeves, and Gladys Sather, who isolated the encephalitis virus from different kinds of mosquitoes inhabiting the

² William McD. Hammon, William C. Reeves, and Gladys Sather: California Encephalitis Virus, A Newly Described Agent, II. Isolations and Attempts to Identify and Characterize the Agent, *Journ. Immunology*, Vol. 69, 1952, pp. 493-510; and Henry G. Cramblett, Howard Stegmiller, and Calvin Spencer: California Encephalitis Virus Infections in Children, *Amer. Medical Assn. Journ.*, Vol. 198, 1966, pp. 128-132.

San Joaquin Valley of California.³ They examined small mammals, domestic fowl, horses, and wild birds for evidence of the virus found in *Aedes dorsalis* and *Culex tarsalis*, and in humans. From among the variety of intermediate natural hosts they identified the mosquito-wild-bird-mosquito cycle of the virus, and they also concluded that a small number of wild mammals might be involved. By 1964 many geographical aspects of the complex California encephalitis group were known.⁴

Use of the conventional tropical medicine approach led some researchers to conclude that the California encephalitis virus group was "widespread geographically," with specific members or strains of the group having more limited distributions.⁵ The basically temperate climate types identified in the United States have been generally found in farms and rural habitats. In some instances, horses and barnyard fowl manifest traits of California encephalitis virus. Many wild birds and small mammals that normally inhabit temperate forests have been found to be immune carriers. A combination of such environmental conditions as woodland, potentially poor drainage, and cycles of periodically heavy rainfall could contribute to outbreaks of California encephalitis in humans.

Still, the Center for Disease Control in Atlanta had received less than fifty reports of confirmed or suspected cases of California encephalitis from state departments of health by 1964.⁶ That year was the turning point for reporting of the disease: the vector of the La Crosse strain of the California encephalitis virus was isolated in the floodplain of a glaciated area in Wisconsin and was identified as *Aedes triseriatus*.⁷ The same strain was subsequently identified in a semirural part of southeastern Pennsylvania.⁸ Several species of *Aedes* were shown to be California encephalitis virus vectors in Ohio, also in 1969.⁹ One glaciated area in central Ohio was considered endemic, and mosquito proliferation was explained by the presence of fairly dense mixed mesophytic forests. Moreover, farm animals were found in the immediate vicinity. Since 1964, reports of California encephalitis virus in Ohio and in some other locations have increased.

ENCEPHALITIS IN THE UNITED STATES

In spite of our greater knowledge of the relationship among several species of mosquitoes and mammals, and of California encephalitis in humans since 1964, reporting at the national scale via the network of local and state health departments is anything but comprehensive. Many infected persons do not manifest "classic" symptoms, and many do not register a complaint. Furthermore, a physician may not be consulted, may diagnose the ailment incorrectly, or may fail to report the disease.¹⁰ If

³ William McD. Hammon and William C. Reeves: California Encephalitis Virus, A Newly Described Agent, I. Evidence of Natural Infection in Man and Other Animals, *California and Western Medicine*, Vol. 77, 1952, pp. 303-309; and Hammon, Reeves, and Sather, *op. cit.* [see footnote 2 above].

⁴ Cramblett, Stegmiller, and Spencer, *op. cit.* [see footnote 2 above].

⁵ Frederick A. Murphy and Philip H. Coleman: California Group Arboviruses: Immunodiffusion Studies, *Journ. Immunology*, Vol. 99, 1967, pp. 276-284.

⁶ Cramblett, Stegmiller, and Spencer, *op. cit.* [see footnote 2 above], p. 128.

⁷ D. D. Watts, S. Pantuwatana, G. R. Defoliart, T. M. Yuill, and W. H. Thompson: Transovarial Transmission of LaCrosse Virus (California Encephalitis Group) in the Mosquito *Aedes Triseriatus*, *Science*, Vol. 182, 1973, pp. 1140-1141.

⁸ "California Encephalitis Observed in Pennsylvania," *Public Health Repts.*, Vol. 85, 1970, p. 314.

⁹ R. A. Masterson, H. W. Stegmiller, N. A. Parsons, C. C. Croft, and C. B. Spencer: California Encephalitis—An Endemic Puzzle in Ohio, *Health Laboratory Sci.*, Vol. 8, 1971, pp. 89-96.

¹⁰ John P. Fox, Carrie E. Hall, and Lila R. Elveback: *Epidemiology: Man and Disease* (MacMillan, London, 1970), 318-322.

no serological tests are made to identify the specific encephalitis subtype, which is more often the case than not, reports are simply classified "etiology unknown." For example, the 1964-1974 annual reports of the Center for Disease Control reveal that 80 to 90 percent of most statewide reporting did not specify a particular type of encephalitis.¹¹ Thus, large numbers of cases were reported from some states, but the particular type of encephalitis was not specified. Such inadequate nationwide reporting does not preclude geographical inquiry into the disease problem, however. We have made the assumption that although much of the reporting of encephalitis from all causes is random, this is not the case with arthropod-borne encephalitis. The decision was made to attempt to uncover nonrandom patterns of occurrence, or deviations from random patterns.

Application of a method developed by Mieczyslaw Choynowski and recently amplified by Neil D. McGlashan to all cases of encephalitis, including "etiology unknown," reported in the United States between 1964 and 1974 reveals a geographical distribution that supports published findings: California and Ohio have consistently reported the highest prevalence of encephalitis (Fig. 1).¹² The Choynowski-McGlashan method relies on examination of Poisson, binomial, or normal distributions of low-incidence disease reporting to better identify those units of observation within a larger study area that consistently show incidence tabulations sufficiently different and statistically significant at the 0.05 level to not be due to chance reporting. Using the encephalitis reporting for the period already mentioned, the assumption was made that cases were independently distributed in time and location by a random process. The actual reporting was used to determine norms, or the expected number of cases.

The patterns in Figure 1 show that reporting is not due to chance in Ohio and California. Other interesting reporting probabilities are also revealed. For example, the Great Lakes region displays a fairly significant pattern, indicating that there is a 95 percent probability that reporting is not due to chance in many places surrounding the lakes. We concluded also that those parts of the country in which reporting is not due to chance at lower probability levels are either primary or secondary endemic regions. Reporting from the West Coast states indicates some chance of periodic arbovirus encephalitis outbreaks in parts of Washington State and possibly in the Willamette Valley of Oregon. In the lower Mississippi Delta and Gulf Coast areas research indicates a 75 percent probability of scattered outbreaks. Conversely, in spite of the well-known La Crosse strain in Wisconsin, reporting from that state has been consistently lower than from surrounding states.

It appears that more comprehensive long-term surveillance is required in the areas of "lesser probability" of chance reporting. Still, enough research has been undertaken in specific locations and reporting is such that some speculation can be made with a lower degree of probability. Thus the pattern shown in Figure 1 serves not only to highlight locations in which medical studies have progressed to the point where larger-scale spatial analysis can be undertaken but also to identify reporting deficiencies in many states. Although currently available data do not permit detailed analysis of all of the areas in which encephalitis may occur, an in-depth spatial and

¹¹ *Summary Repts.*, Center for Disease Control (formerly Communicable Disease Center), Atlanta, 1964-1974.

¹² Mieczyslaw Choynowski: *Maps Based on Probabilities*, in *Spatial Analysis: A Reader in Statistical Geography* (edited by Brian J. L. Berry and Duane F. Marble; Prentice-Hall, Inc., Englewood Cliffs, N. J.,

REPORTED CASES OF CALIFORNIA ENCEPHALITIS IN OHIO

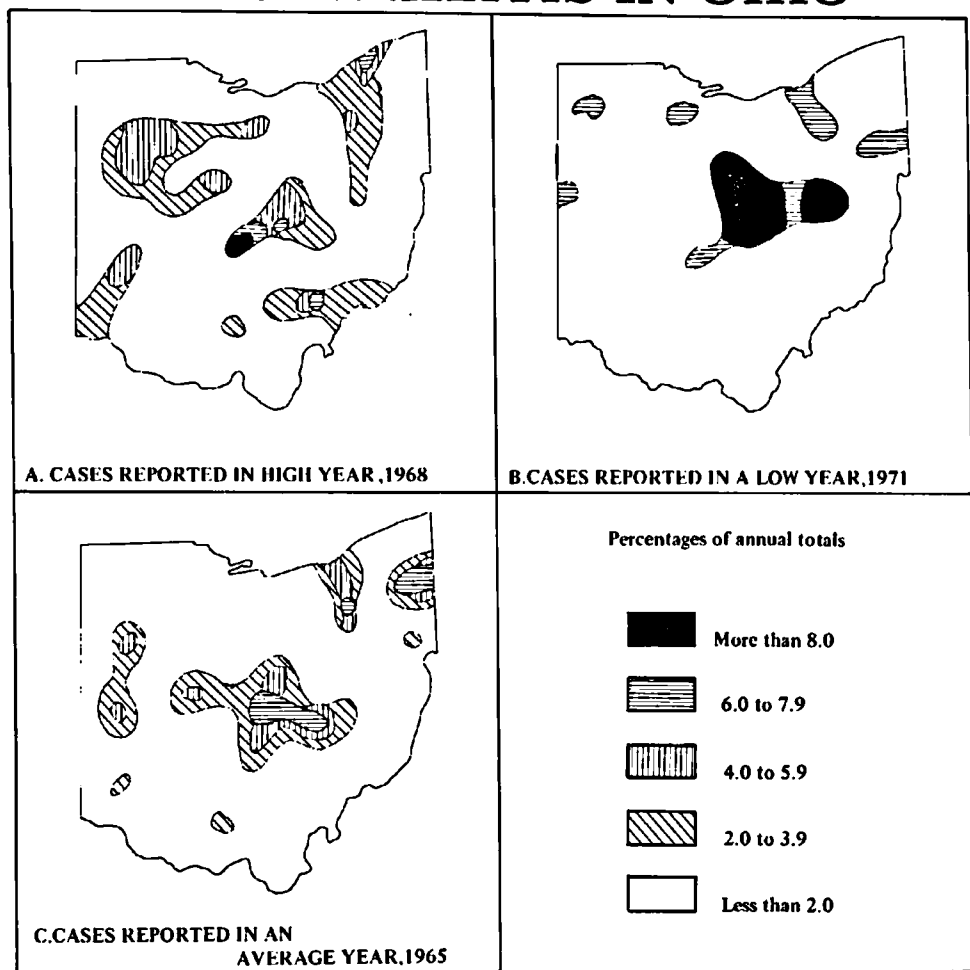


FIG. 2—California encephalitis reporting in Ohio for a high year (1968), a low year (1971), and an average year (1965). Reporting for 1965 proved to be the most significant statistically.

temporal analysis of data from Ohio can be performed. This analysis not only will add to our knowledge of environmental risk factors of California encephalitis but also will suggest a methodology that can be used in other areas even more endemic to arthropod-borne encephalitis than is now realized.

CALIFORNIA ENCEPHALITIS IN OHIO

Between 1964 and 1975, 340 cases of confirmed or presumed California encephalitis were identified by the Communicable Disease and Laboratory Division of the Ohio Department of Public Health. The identification of more than 200 of these cases from

1964 through 1969 led Ralph Masterson and others to develop geographically oriented studies of the disease in 1971. They postulated a general northeast-to-southwest axis of encephalitis cases in Ohio, which they said was related to population density.¹³ Animal reservoirs were identified in rural wooded areas of the state, and several species of mosquito present in the forested places were found to be infected with California encephalitis virus. Of special interest were virus-positive pools of *Aedes triseriatus* larvae discovered in larger natural holes and in furrows of more mature silver maple trees. In a more detailed analysis, Richard L. Berry and others focused on the distribution of California encephalitis in Knox County. They scrutinized several species of infected *Aedes* and found breeding areas in a mixed mesophytic forest that included the silver maple.¹⁴ One village, Gambier, reported many more California encephalitis cases than had any other single place in recent years. Surprisingly, mosquitoes were initially not perceived as a significant problem by residents of the village. Subsequent surveillance and control measures have recently reduced the prevalence of encephalitis in Gambier, but the disease continues to occur in other parts of Ohio.

The distribution of California encephalitis in Ohio reveals several patterns of localization. In each of the twelve years under investigation, the cases occurred from late June through October. In addition, most annual temporal distributions were fairly normal, with peaks and/or modes usually in either late August or early September.¹⁵ The average annual number of cases for the state exceeded thirty, compared with a national average of less than fifty for the same twelve years. The total number of reported cases of California encephalitis varied widely (Fig. 2). In some years the disease did not occur at all; it reached its peak in 1968, when forty-six cases were reported. Clusters occurred in the vicinity of Akron and in parts of Cleveland (Fig. 2A). The very dark area in the middle of the state reflects the outbreak in an older portion of Columbus, where drainage problems developed. The problems have been resolved, and the city has not reported as many cases in any year since 1968.

It is also useful to examine the data for years of low incidence (Fig. 2B) in attempts to identify significant endemic disease areas. In the low year of 1971, reported cases of California encephalitis were concentrated in the central part of Ohio, in and around Knox County. Small clusters also appeared in the northeast. Few cases were reported in the southern portion of the state. The pattern for 1965 (Fig. 2C) is most representative of the average incidence expected in the state, given no additional control measures. In other words, the central part of the state continued to report the highest incidence of California encephalitis, and two significant clusters of higher reporting occurred in the northeast.

The distribution of cases in 1965 also proved to be the most significant in statistical tests with the population at risk.¹⁶ In addition to significance at the 0.05 level, the moderate correlation ratio (E^2) of 0.55 indicated a fair amount of strength. During an average year for California encephalitis in Ohio, therefore, we have additional proof that a youthful population at risk (population eighteen years old and younger) is a

¹³ Masterson and others, *op. cit.* [see footnote 9 above].

¹⁴ Richard L. Berry, Margaret A. Parsons, Barbara J. LaLonde, Howard W. Stegmiller, Judy Lezio, Nathan Jalil, and Ralph A. Masterson: Studies on the Epidemiology of California Encephalitis in an Endemic Ohio Area in 1971, *Amer. Journ. Tropical Medicine and Hygiene*, Vol. 24, 1975, pp. 992-998.

¹⁵ Cramblett, Stegmiller, and Spencer, *op. cit.* [see footnote 2 above].

¹⁶ No study of this nature is complete without an examination of the population at risk. Since Figure 2 and the data from which it is derived are based on countywide reporting, an analysis of variance was

CALIFORNIA ENCEPHALITIS AND FLOODPLAINS

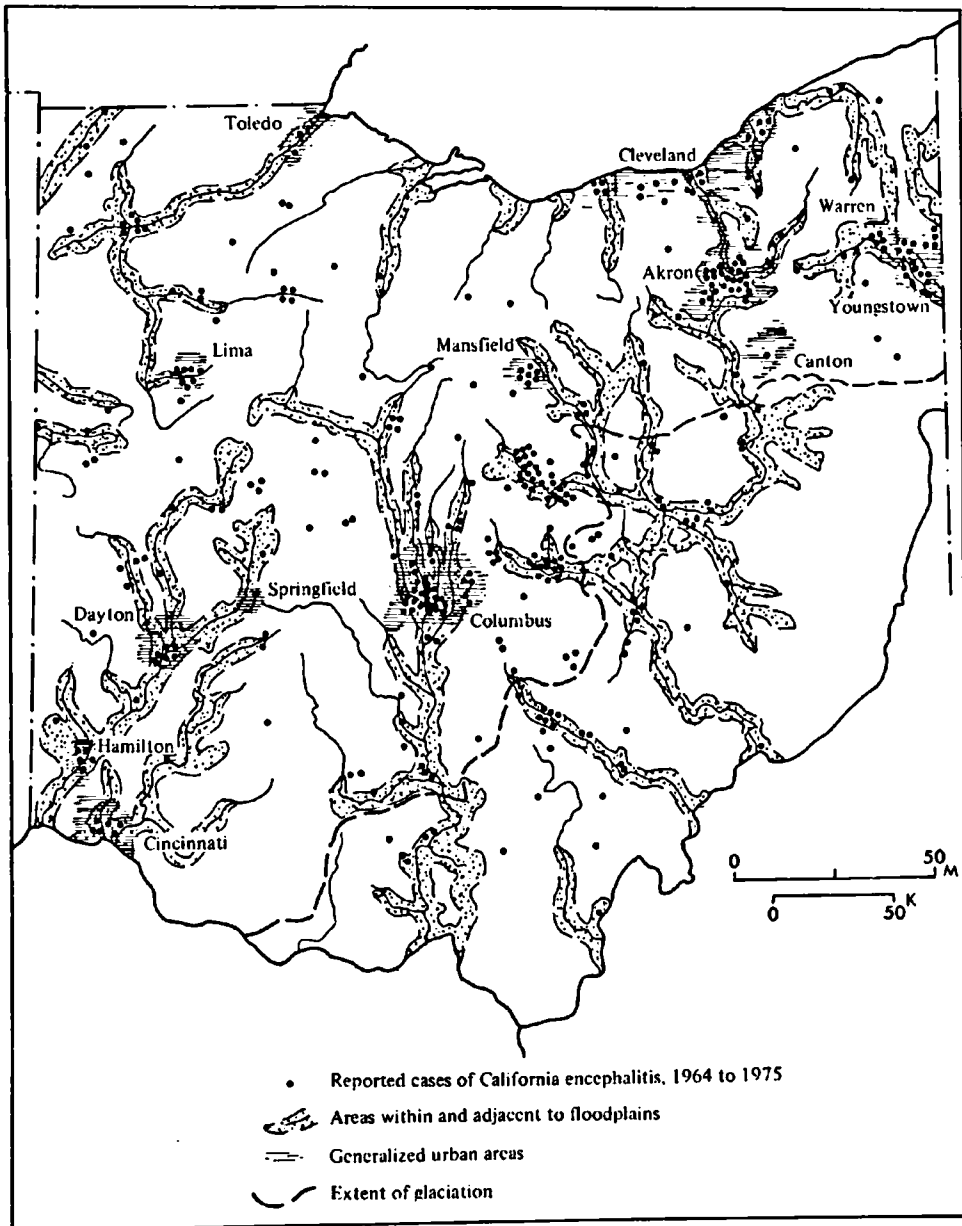


FIG. 3—Confirmed California encephalitis cases in Ohio, 1964–1975, in relation to floodplains and major urban places.

performed for each of the representative years with counties as units. In each instance the analysis of variance was developed using the groupings from the discriminant analysis as different classes of reporting cross-tabulated against quartiles of the percentage of the population in each county up to and including eighteen years of age according to the 1970 census. Because almost all of the cases reported occurred in people under the age of eighteen, it was possible to divide the population into workable groups for statistical testing in this manner. The high year, 1968, and the low year, 1971, did not prove to be statistically significant at the 0.05 level. In 1971 there were simply not enough cases to hold up under the analysis of variance; and the 1968 distribution was heavily skewed owing to the outbreak in Columbus.

GLACIAL DEPOSITS OF OHIO

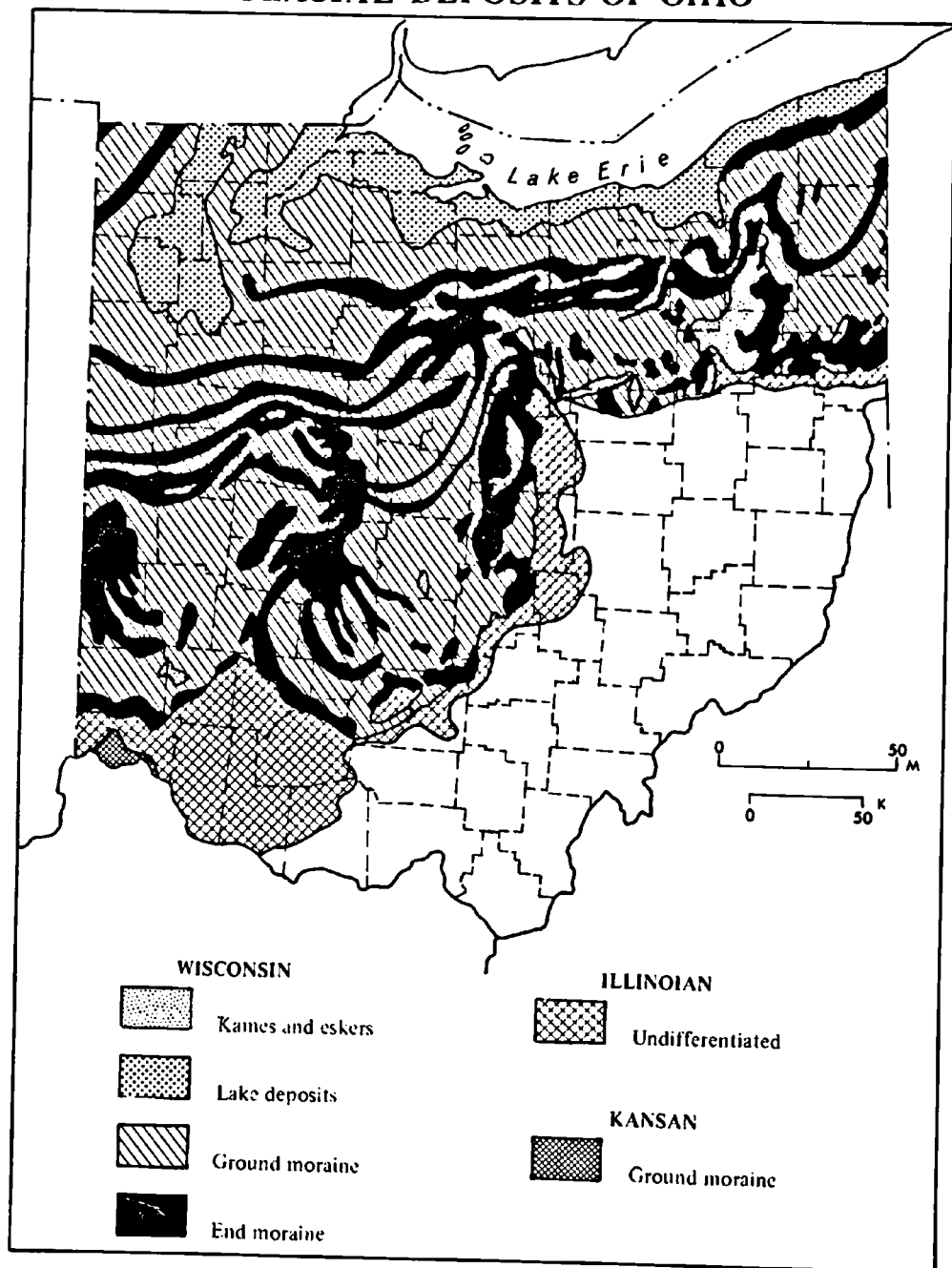


FIG. 4—Glacially derived landforms in Ohio.

PHYSIOGRAPHIC REGIONS AND ENDEMIC AREAS

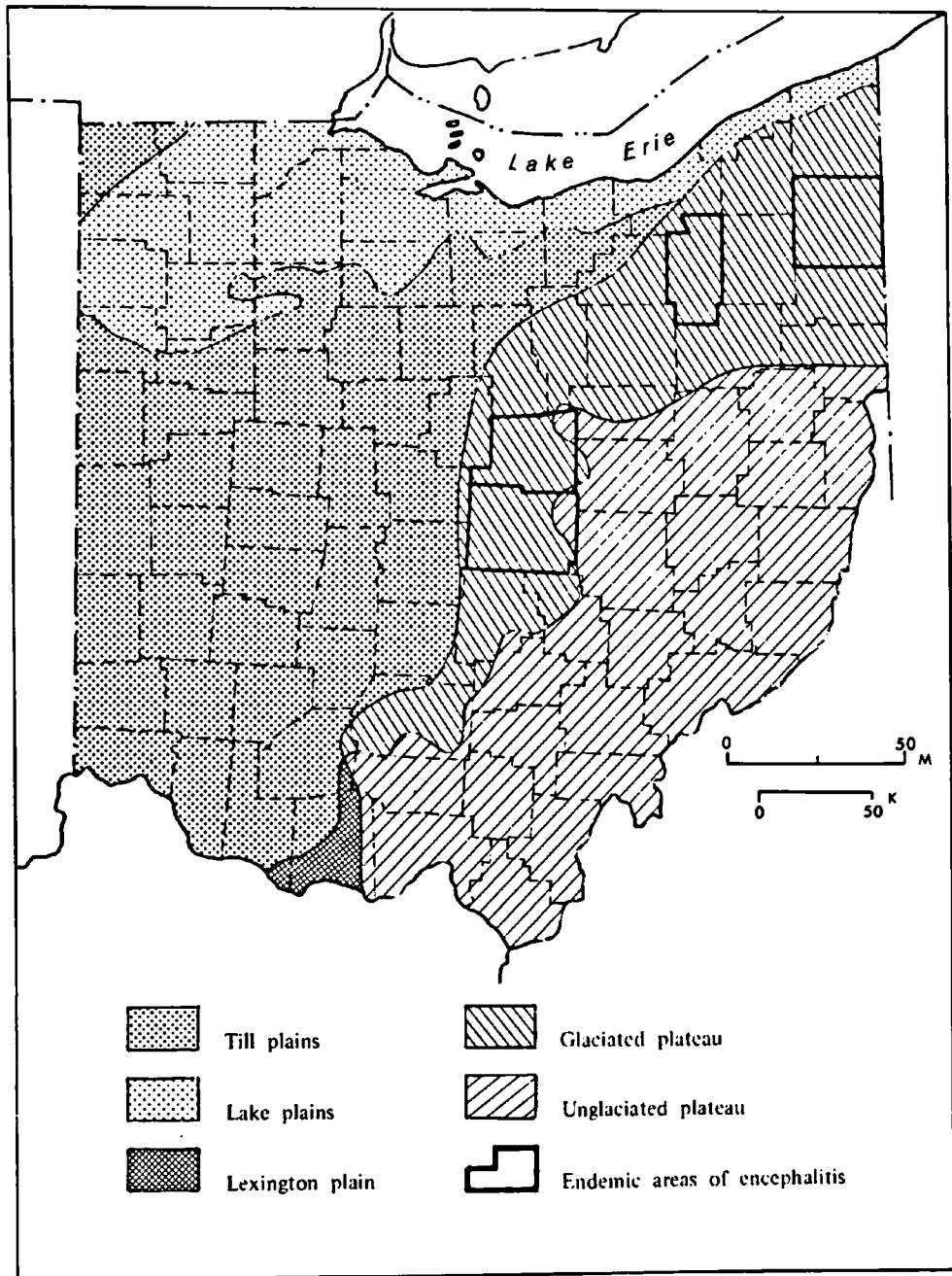


FIG. 5—Major physiographic regions of Ohio, and counties in which California encephalitis is endemic.

significant factor to be considered in such studies. A stronger correlation ratio would have indicated that population at risk is indeed a major element in the appearance of the disease.

A visual explanation of the factors related to California encephalitis is provided in Figure 3. The clusters of cases in the vicinity of urban places are immediately apparent and verify the analysis of variance. Equally as intriguing are the several

TEMPORAL CYCLES OF ENCEPHALITIS AND RAINFALL

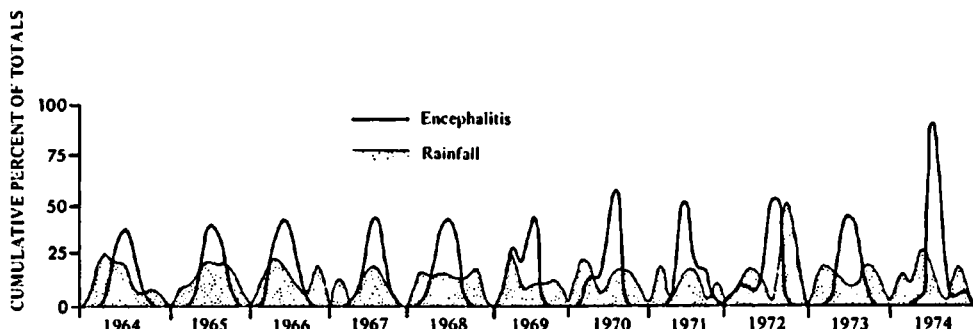


FIG. 6—Cycles of rainfall and California encephalitis in the four Ohio counties in which the disease is endemic.

major and minor concentrations of reporting in parts of the state that are not heavily urbanized. The correlation between these clusters and floodplains is striking, even allowing for minor displacements owing to the scale of the map. Two major concentrations occurred northeast of Columbus in areas that are not heavily populated on a year-round basis. One of these locations is the Mohican River area, which is extensively used for recreational purposes.

The patterns revealed by Figure 3 help to explain why the analysis of variance did not result in a stronger correlation ratio. They also raise questions about glaciation and other environmental factors. Two-thirds of Ohio was glaciated during the most recent Ice Age. The Illinoian and basically Wisconsin glaciation left distinct features in all of Ohio except the southeast (Fig. 4). Crisscrossing the northern part of the state and moving down into the western part are a series of end moraines.¹⁷ Kames and eskers are found in some parts of the northeast. The glaciation disrupted former drainage patterns, and this often resulted in floodplainlike depositions without major streams. In many of those locations the potential exists for accumulations of water suitable as a habitat for mosquito larvae. Much of western Ohio is heavily agricultural, however, and there are fewer concentrations of the kinds of mesophytic forests identified in the literature as containing the probable encephalitis environmental risk factors under discussion. Exceptions in the western part of the state include slopes that are too steep for agricultural land use, and wooded and urbanized locations.

It is also useful to consider the physiographic regions of Ohio (Fig. 5). The southeastern part of the state, which was unglaciated except for outwash in stream valleys, contains an abundance of hills and valleys. It is quite sparsely populated. The northern portion contains a lake plain. A comparison of Figures 3 and 5 indicates that

¹⁷ Allen G. Noble and Albert J. Korsok: Ohio—An American Heartland, *State of Ohio, Dept. of Natural Resources, Division of Geological Survey, Bull. 65*, Columbus, 1975, pp. 27–35.

most of the encephalitis cases in the lake plain were concentrated near the mouths of the streams. Much of western Ohio consists of till plains that support, as already mentioned, substantial agricultural activities in rural counties. Woodland is not extensive and the population is dispersed. Along a northeast-central Ohio axis lies a glaciated Appalachian plateau. Many different kinds of landscapes can be found because of the former valleys that have been buried by glacial fill in this zone. An examination of Figures 4 and 5 shows that mosquito-breeding grounds can develop in many sites in this region. Furthermore, when Figure 3 is viewed once more, with the exception of the Columbus cases, it is evident that major clusters of encephalitis have occurred primarily in the glaciated plateau area of the state. We are once again reminded of the landform-poor-drainage-woodland-population-density combination of factors.

Clearly, the glaciated plateau portions of Ohio contain those environmental characteristics necessary for the proliferation of mosquitoes that transmit California encephalitis. For this reason four counties in the glaciated plateau are considered endemic (Fig. 5). These counties have been selected for more detailed temporal analysis.

TEMPORAL ASPECTS OF CALIFORNIA ENCEPHALITIS

Empirical studies of the epidemiology of California encephalitis indicate a strongly defined, cyclical pattern that recurs each year from June to late October.¹⁸ Moreover, according to one study, these temporal cycles occur in sites that reaffirm the environmental factors identified in our work.¹⁹ For comparative analysis here, four counties—Knox, Summit, Licking, and Trumbull—in which California encephalitis is endemic and which have the kinds of environmental associations already identified were selected for detailed time-series analysis. The environmental factors are taken as static, and cycles of rainfall are utilized as the dynamic mechanism leading to the periodic accumulation of excessive water and hence to the propagation of mosquitoes.

Between 1964 and 1975 definite cycles of California encephalitis can be identified from the eighty-six confirmed cases in these four counties (Fig. 6). Comparable numerical scales for encephalitis and rainfall were formulated by converting numbers for each year to cumulative percentages of annual totals over the entire time period. Most years were marked by one pronounced encephalitis peak, but in some years there were minor oscillations. The amplitude of the peak for each year gives some indication of the rates of increase and decrease of known cases of California encephalitis. Knowledge of the rate of increase, particularly from one encephalitis season to the next, in the four counties shows the temporal rate of diffusion of the disease.

For most of the years under investigation, the cycles of average rainfall were not nearly as regular as the cycles of encephalitis (Fig. 6). Thus most of the time-span distributions do not reflect the same amplitudes as the encephalitis data. The most important aspect of Figure 6 is that in most years the onset of accumulated rainfall occurred before the onset of encephalitis. In other words, there was sufficient time, usually from three to four weeks, for water to accumulate in mosquito-breeding habitats.

For simultaneous statistical comparison of rates of increase of rainfall and enceph-

¹⁸ Cramblett, Stegmiller, and Spencer, *op. cit.* [see footnote 2 above].

¹⁹ Berry and others, *op. cit.* [see footnote 14 above].

TABLE I—CROSS-SPECTRAL COMPARISONS OF CALIFORNIA ENCEPHALITIS AND RAINFALL IN KNOX, SUMMIT, LICKING, AND TRUMBULL COUNTIES, OHIO

YEAR	GAIN OF CALIFORNIA ENCEPHALITIS OVER RAINFALL	COHERENCE BETWEEN CALIFORNIA ENCEPHALITIS AND RAINFALL	LAG BETWEEN ONSET OF RAINFALL AND ONSET OF CALIFORNIA ENCEPHALITIS (in weeks)	LAG BETWEEN ONSET OF RAINFALL AND DATE RAINFALL INCREASE EXCEEDED BY ENCEPHALITIS INCREASE (in weeks)
1964	0.00	0.4709	4.0	8.0
1965	0.34	0.2793	7.5	9.0
1966	0.04	0.4646	4.5	7.0
1967	0.37	0.7082	7.5	2.0
1968	0.06	0.0636	6.0	8.0
1969	0.07	0.5060	1.0	1.5
1970	0.24	0.7323	5.0	7.0
1971	0.08	0.5795	8.0	8.0
1972	0.23	0.7380	3.0	9.0
1973	0.11	0.3360	8.0	9.0
1974	0.12	0.5348	10.0	10.5
1975	0.37	0.3580	6.0	0.0

Source: Computed by authors from information supplied by the Ohio Department of Public Health.

alitis a cross-spectral comparison proved to be useful.²⁰ It is important to know, for example, not only how the rates of increase compare but also the particular time at which the increases in encephalitis exceed those of rainfall and the subsequent time lags (Table I). Four measures were developed for each of the years. The first measure, the gain of California encephalitis over rainfall, is the statistic that indicates the differences in rates of acceleration. If this statistic is fairly low, rates of increase are initially approximately the same; and the higher the statistic the greater the gain of encephalitis over rainfall. The second statistic used is coherence, which is analogous to correlation (measured from 0 to 1). The coherence statistic is generally intended to indicate the years in which the encephalitis cycles most closely correlated with rainfall cycles. In addition, two lag measures were computed. The first showed the amount of time between the onset of rainfall in late summer and the onset of encephalitis as established by the confirmation of cases. The second measure of lag is intended to show the amount of time between the date on which the late summer rainfall began and the date on which the rate of encephalitis increase exceeded that of rainfall.

In some years—1964 and 1968, for example—initial gain was slight in terms of rates of increase of rainfall and encephalitis, but eventually a modest correlation could be established between the two phenomena. The years with the highest coherence, or correlation, were 1967, 1970, and 1972. The gain measures were somewhat higher than they were in 1964 and 1968, indicating a more rapid take-over by encephalitis. In 1974 and 1975 the numbers of confirmed cases of California encephalitis decreased because the Ohio Department of Public Health instituted more mosquito-control measures in cooperation with local health departments. By 1975 there was no measurable overtake lag because many control measures were in effect in mosquito-breeding places adjacent to residences where reported incidence had been higher than usual. This indication of effectiveness of control measures is encouraging.

The association between California encephalitis and rainfall stands out even more

²⁰ See J. N. Rayner: *An Introduction to Spectral Analysis* (Pion Ltd., London, 1971), pp. 93–101. In this work Rayner demonstrates the utility of cross-spectral techniques in tracing weather conditions from one Pacific island to another.

RAINFALL AND ENCEPHALITIS IN ENDEMIC COUNTIES

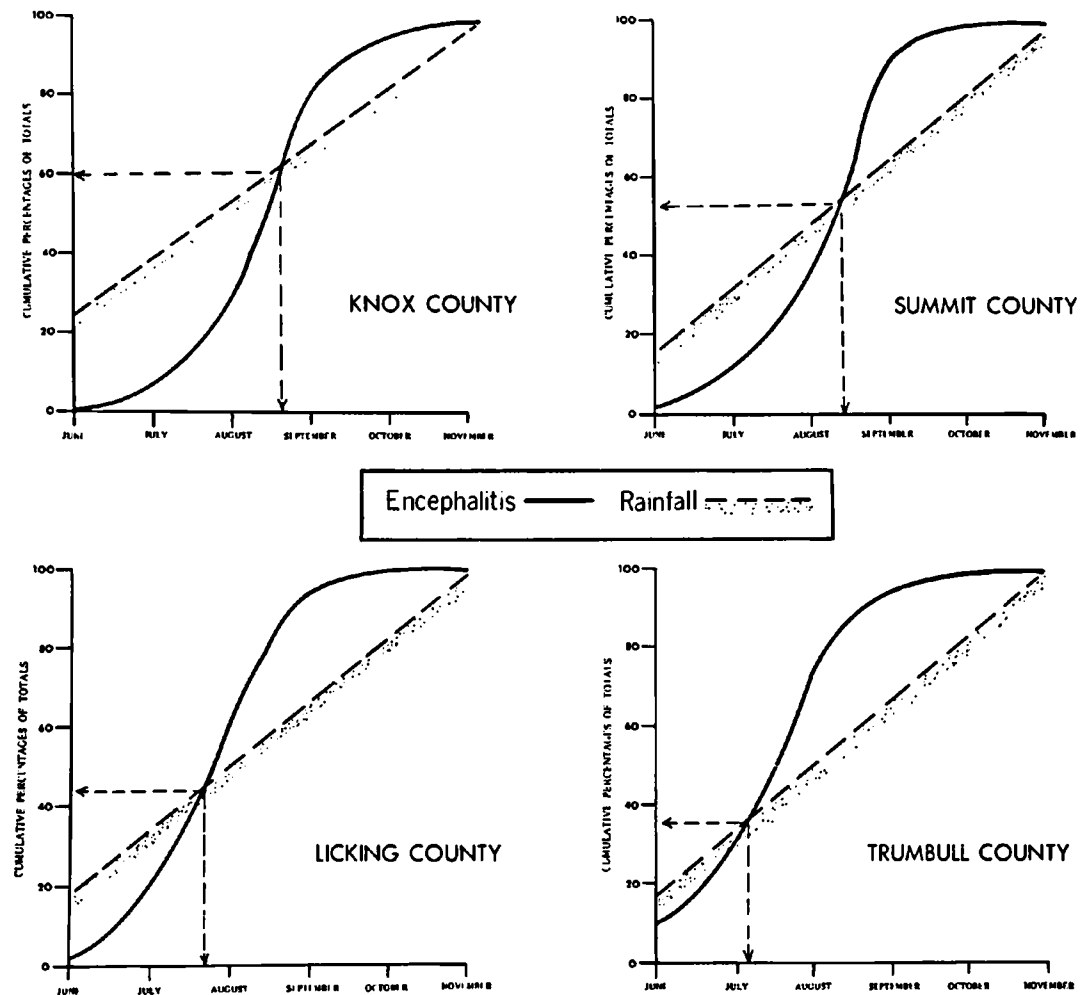


FIG. 7.— Rates of increase of California encephalitis and rainfall in the four Ohio counties in which the disease is endemic.

clearly when each county is analyzed separately and when associations are expressed as a cumulative or logistic distribution (Fig. 7).²¹ To do so, information for the twelve-year period was examined on a monthly average basis for rainfall and encephalitis. For example, the cumulative proportion of encephalitis cases could best be expressed by the logistic or asymptotic curve. Conversely, the cumulative proportion of rainfall was best fit by a linear function. In every instance the rate of encephalitis increase was more rapid than that of rainfall, regardless of location and the number of cases. In Knox County, long established as an endemic region, the disease spread slowly at first, but then the diffusion of cases accelerated, to reach a total of thirty-eight. Trumbull County, with only fifteen encephalitis cases, expressed a similar associa-

²¹ See M. S. Bartlett: *Stochastic Population Models in Ecology and Epidemiology* (Methuen and Company, Ltd., London, 1960), pp. 35-44.

tion. The actual time lag, even though the number of cases was smaller, was substantially less in Trumbull County than in Knox County, as would be expected.

In general, then, a definite association can be established between rainfall and confirmed cases of California encephalitis in endemic areas. The higher the number of cases, the longer the actual time lag between the onset of encephalitis and the point at which the rate of encephalitis increase exceeds that of rainfall. The rate of encephalitis increase is best described by a logistic curve characteristic of the diffusion of disease as well as of many other phenomena, but the rate of increase in rainfall is best indicated by a linear fit. At some point the cumulative proportion of encephalitis cases exceeds that of rainfall. In many places, endemic California encephalitis sites are known intuitively, and control measures are frequently used, but there is some question as to whether these control measures are implemented early enough. On the basis of these findings we contend that timely control measures can be more effective in preventing the diffusion of California encephalitis if environmental risk factors are fully understood and if, within the context of the logistic increase, measures are implemented soon enough.

A FRAMEWORK FOR CONTINUED INVESTIGATION

We have no reason to assume that parts of California and Ohio are the only areas in the United States in which California encephalitis is endemic. Indeed, on the basis of the findings of this study we have reason to believe that the disease merits analysis in several other regions of the country. The entire Great Lakes area stands out clearly in Figure 1. Parts of Washington and Oregon have had encephalitis outbreaks in the past, but information about their etiological agent is scant. Likewise, the Mississippi delta and valley areas are known to have vast potential breeding places for several vectors of arboviral encephalitis, as are parts of Georgia and Florida. Clearly, there is need for better etiological diagnosis of all types of encephalitis cases and for full cooperation with the Center for Disease Control.

It is of particular interest that parts of the Great Lakes region exposed to Pleistocene glaciation contain environmental characteristics correlated with the presence of California encephalitis. Certainly a large measure of this encephalitis probability is due to the disruption of former drainage patterns and to other landform phenomena caused by glaciation. When environmental factors resulting from glaciation represent the static elements necessary for the breeding of vector species of mosquitoes, sufficient rainfall in the late summer and fall appears to be a dynamic element leading to mosquito proliferation and to outbreaks of California encephalitis. In Ohio selective antimosquito measures are relatively successful in controlling the disease.

Owing to recent discoveries of the long-term chance of illness in humans and of the risk of death to birds, spraying with insecticides is not now popular with the general public. Yet the risk of encephalitis alone is sufficient cause for the use of such measures to control mosquito populations. Knowledge of specific risk environments with the conditions identified in this analysis can lead to systematic planning and implementation of appropriate mosquito-control programs. As shown by the temporal analysis offered here, timeliness of such programs must also be considered. In many endemic areas, spraying of selected locations should be started earlier than it has been; that is, in late July instead of in August. Aspects of "where," "why there," and "when" to initiate control programs thus are crucial to public health practitioners.

THE POSTWAR MOBILITY TRANSITION IN EASTERN EUROPE*

ROLAND J. FUCHS and GEORGE J. DEMKO

MOBILITY, including both migration and circulation, defined as short-term, repetitive, or cyclical movements, has increasingly been seen as linked to processes of economic development, modernization, and urbanization. Wilbur Zelinsky argues the existence of a mobility transition pattern in which phases of mobility correspond to stages of modernization. The mobility transition, as the parallel demographic transaction, is seen as "irreversible" and as progressing with "fatalistic inevitability through distinct phases."¹ The first phase, the Premodern Traditional Society, is characterized by limited migration and circulation. It is followed by the Early Transitional Society, which reflects massive rural-urban migration and significant growth in circulation. In Phase III, the Late Transitional Society, rural-urban migration declines as circulation increases; and Phase IV, the Advanced Society, sees a further decline in rural-urban migration and accelerating urban-urban migration and circulation. In the Future Superadvanced Society, migration will theoretically decline further because of the increase of some forms of circulation and communication and because of possible imposition of strict political control of internal as well as international movements.

In this article we shall examine the decline of migration and its replacement by commuting in Eastern Europe, specifically in the advanced industrial nations of the Soviet Union, the German Democratic Republic, Czechoslovakia, Poland, and Hungary. Since World War II these countries have experienced changes in mobility that are characteristic of the passage in Zelinsky's model from the Early Transitional Society phase through the Advanced Society phase and even exhibit elements, in the attempts to control mobility, of his Future Superadvanced Society. We, however, view the degree and rate of this transition as the result not of inexorable and universal processes but of deliberate government interventions in the economies of the socialist nations. These interventions have severely affected the characteristics and consequences of the mobility transition, resulting in distortions in Eastern European patterns that raise questions as to the wide applicability and utility of the mobility transition hypothesis.

POSTWAR MOBILITY TRENDS IN EASTERN EUROPE

With the exception of the Soviet Union (for which consistent and complete data are lacking), the rate of internal migration has declined sharply in recent decades in the individual countries of Eastern Europe. From peak levels established in the early and mid-1950's the rate of migration in the German Democratic Republic has declined to a third of its former level, and in Poland, Czechoslovakia, and Hungary to

* This research is part of a larger investigation of spatial population policies in Eastern Europe sponsored by grants from the National Science Foundation.

¹ Wilbur Zelinsky: The Hypothesis of the Mobility Transition, *Geogr. Rev.*, Vol. 61, 1971, pp. 219-249, reference on p. 249.

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approximately half the previous rate. More specifically, the rate of internal migrants per thousand inhabitants in the German Democratic Republic declined from 47.9 in 1953 to 15.4 in 1972, in Poland from 54.3 in 1952 to 26.6 in 1974, in Czechoslovakia from 54.5 in 1951 to 25.6 in 1973, and in Hungary from 48.0 in 1957 to 24.5 in 1972.² In general, rural-urban flows have dominated, with urban-urban flows second in importance.³ However, directional flows by rural and urban sectors vary considerably from country to country (Table I). In the Soviet Union in 1968 and 1969 urban-urban flows were dominant and in Hungary in 1972 rural-rural flows prevailed. In Poland the proportion of rural-urban flows increased from 1961 to 1973, while that of urban-urban flows remained stable, contradicting the hypothesized mobility transition sequence. In the Soviet Union and Hungary migration distances, which are not accounted for in the mobility transition hypothesis, have become shorter over time.⁴ Mobility patterns in the Soviet Union are further complicated by the annual movements of 1,500,000 students and other seasonal workers.⁵

The changes in migration patterns clearly reflect the fact that a mobility transition is in process; however, the rapidity of decline in migration, the complexity of direction of flows, and the changing distances of movements combine to defy a simple typology by stages that correspond to those outlined in Zelinsky's hypothesis. Instead, an overlapping of phases suggests a telescoped development process, probably owing to changing government policies in Eastern Europe.

THE DECLINE OF MIGRATION AND THE RISE OF COMMUTING

A number of scholars have attempted to explain the abrupt decline in total migration rates in terms of various factors, including the large postwar refugee population, changing governmental policies on agriculture and collectivization, a declining pool of potential migrants, and housing limitations.⁶ Generally overlooked has been the relationship between the decline in migration and the concomitant rise in commutation.⁷

As migration rates have declined, commuting rates have increased to the point where substantial portions of the labor force in each of the Eastern European nations are now engaged in work movements that require journeys outside their administrative district of residence.⁸ The proportion of commuters in the labor force is lowest in the Soviet Union, where 12 percent of blue- and white-collar workers and students

² Leszek A. Kosiński: *Demographic Characteristics and Trends in Northeastern Europe* (a paper presented at the Conference on Demography and Urbanization in Eastern Europe, University of California at Los Angeles, Feb. 5-9, 1976), Table 16.

³ L. A. Kosiński: *Interregional Migration in East-Central Europe*, in *People on the Move* (edited by Leszek A. Kosiński and R. Mansell Prothero; Methuen, London, 1975), pp. 277-292.

⁴ S. A. Polsky, I. M. Taboriskaya, and V. N. Chapek: *Pendulum Migration: Its Essence, Functions, Trends of Development and Control*, in *Geography of Population* (edited by S. A. Kovalev and B. S. Khorev; Internat. Geogr. Union, Moscow, 1976), pp. 198-200, reference on p. 200; and Paul A. Compton: *Population Change and Population Policy in Hungary*, in *Demographic Developments in Eastern Europe* (edited by Leszek A. Kosiński; Praeger, New York, 1977), pp. 284-308, reference on p. 300.

⁵ See B. Khorev: *Migration Mobility of the Population of the USSR*, *Problems of Economics*, Vol. 19, No. 12, April, 1977, pp. 70-86, reference on p. 76.

⁶ Kosiński, *Interregional Migration* [see footnote 3 above], pp. 283-285.

⁷ However, the interdependence between migration, commuting, and other forms of mobility has been noted by Khorev, *Migration Mobility* [see footnote 5 above], p. 71.

⁸ In the socialist countries of Eastern Europe the definition of commuting is generally limited to those journeys to work involving the crossing of an administrative-territorial boundary of a region or city. In the Soviet Union trips for study purposes outside the administrative district of residence are also included.

TABLE I—DIRECTIONAL FLOWS OF INTERNAL MIGRATION
(In thousands)

DIRECTION	COUNTRY							
	Poland (1961)		Poland (1973)		Hungary (1972)		Soviet Union (1968-1969)	
	#	%	#	%	#	%	#	%
Urban to urban	258.3	22.2	192.5	22.9	26.9	10.6	5,290.0	38.1
Urban to rural	212.8	18.3	107.6	12.8	41.2	16.2	1,759.0	12.7
Rural to urban	283.9	24.4	275.6	32.9	74.5	29.3	4,364.0	31.4
Rural to rural	407.5	35.1	263.7	31.4	111.7	43.9	2,471.0	17.8
TOTAL	1,162.5	100.0	839.4	100.0	254.3	100.0	13,884.0	100.0

Sources: For Poland and Hungary: Kosiński, Demographic Characteristics [see text footnote 2], Table 17; for the Soviet Union: "Itogi Vsesoyuznoy Perepisi Naseleniya 1970 Goda [Results of the All-Union Census of Population of 1970]" (Tsentral'noye Statisticheskoye Upravleniye [Central Statistical Administration]; Statistika, Moscow, 1974), Vol. 7, p. 8.

commuted in 1967, and in Poland, where approximately 20 percent of employees in the socialized sector commuted in 1968.⁹ In Hungary, the German Democratic Republic, and Czechoslovakia the proportion of commuters among "economically active" workers is higher—in Hungary accounting for 30 percent of females and nearly 40 percent of males in 1973,¹⁰ in the German Democratic Republic for 33.3 percent of the total in 1971,¹¹ and in Czechoslovakia for 37.2 percent of the total in 1970.¹² Available historical data, furthermore, suggest a rapid increase in commuting over the last fifteen years: in Czechoslovakia commuters increased from 2,324,000 in 1961 to 2,598,000 in 1970;¹³ in Hungary there were approximately 613,000 commuters in 1960, 901,000 in 1966, and 1,300,000 in 1973;¹⁴ in the Soviet Union rural commuters alone "increased from 3.35 million in 1965 to 4 million in 1970."¹⁵ In the other socialist nations, although precise historical data are lacking, similar growth trends have been observed.¹⁶

An interdependence in the form of an inverse relation between rates of migration and commutation has been noted in previous studies of Western societies.¹⁷ The

⁹ The Soviet figure is cited in B. S. Khorev, T. K. Smolina, and A. G. Vishnevskiy: Mayatnikovaya Migratsiya v SSSR: Eye Izucheniye [Commuting in the USSR: Its Study], in Problemy Migratsiya Naseleniya: Trudovyykh Resursov [Problems of Population Migration: Labor Resources] (edited by D. I. Valentei and others; Statistika, Moscow, 1970), pp. 100-109, reference on p. 100. The information on Poland is cited in "Urban Demography: Past Developments and Projections," *Poland*, No. 7, Radio Free Europe, 1974, p. 11.

¹⁰ "Urban Demography: Past Developments and Projections," *Hungary*, No. 7, Radio Free Europe, 1974, p. 12.

¹¹ Luise Grundmann and Hans Neumann: Territoriale Probleme der Arbeitspendelwanderung, *Petermanns Geogr. Mitt.*, Vol. 118, No. 4, 1974, pp. 267-270, reference on p. 267.

¹² M. Macka: Changes in the Development of Commuting in the Czechoslovak Socialist Republic During 1961-70, in Additional Volume (edited by A. A. Aseev and others; Internat. Geogr. Union, Moscow, 1976), pp. 228-280, reference on p. 229.

¹³ *Ibid.*, p. 229.

¹⁴ Urban Demography [see footnote 10 above], p. 12.

¹⁵ Khorev, Migration Mobility [see footnote 5 above], p. 78.

¹⁶ Yu. L. Pivovarov: Mayatnikovaya Migratsiya v Sotsialisticheskikh Stranakh Evropy [Commuting in the Socialist Countries of Europe], in Problemy Migratsiya Naseleniya [see footnote 9 above].

¹⁷ Lakshman Yapa, Mario Polese, and Julian Wolpert: Interdependencies of Commuting, Migration and Job Site Relocation, *Econ. Geogr.*, Vol. 47, 1971, pp. 59-72; John H. Holmes: Linkages Between External Commuting and Out-Migration: Evidence from Middle-Eastern Pennsylvania, *Econ. Geogr.*, Vol. 48, 1972, pp. 406-420; and James O. Wheeler: The Urban Circulation Noose (Duxbury, North Scituate, Mass., 1974), pp. 48-52.

CAUSAL MODEL OF THE MOBILITY TRANSITION IN EASTERN EUROPE

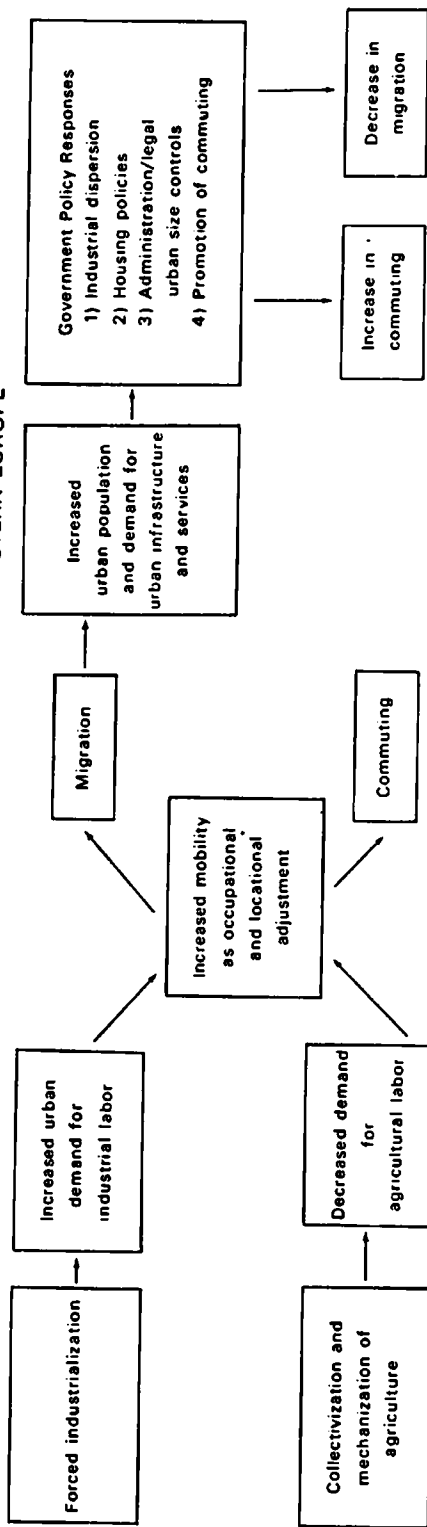


FIG. 1

substitution over time of commuting for migration also conforms to Zelinsky's model, which provides for an increasing absorption of potential migration by alternative forms of circulation as a society progresses from "late transitional" to "advanced" and "superadvanced" status.¹⁸ Superficially, therefore, it would appear that the transition from migration to commutation in Eastern Europe conforms to a universal process and resembles a similar transition in Western societies; however, a more detailed examination of its causes, characteristics, and consequences reveals its unique character. Fundamental differences become apparent when we compare the evolution of mass commuting in Eastern Europe with that in North America.

The rise of commuting in North America was essentially a result of changes in occupational structure, transportation technology, and individual residential preferences. As James E. Vance demonstrated in his study of labor catchment areas, evolutionary processes in transportation technology led to an expansion of urban laborsheds and the separation of work places and residences.¹⁹ The automobile made practical catchment areas beyond the linear routes served by fixed rail and bus lines and greatly expanded potential commuting areas. In North America commuting also increased because of the peripheral suburban growth of cities, a preference on the part of upper-income residents for suburban and semirural environmental amenities and of young and middle-income households for lower-cost housing and better schools. This outward move was accelerated by the rise of racial tensions, inner-city crime, and other social problems.²⁰ Recent trends toward dispersal of industries and offices to the suburbs have further increased commuting, particularly intersuburban and reverse city-to-suburb commuting.²¹

Commuting in Eastern Europe is a response to very different circumstances and processes (Fig. 1). As a result of the postwar political changes, communist governments have imposed the Soviet development model, with its emphasis on industrial investment and on the collectivization and mechanization of agriculture.²² For reasons of efficiency, rapid and forced industrial growth was initially concentrated in capital cities and in the presocialist industrial centers, which had the advantages of a skilled resident labor force, technical infrastructure, and market or resource access.²³ The increased mobility of the population was the mechanism that permitted occupational and locational adjustments between the increased urban demand for industrial workers and the increased rural supply of surplus agricultural labor. Initially migration, particularly rural-urban migration, dominated as the specific mobility measure by which locations and occupations were adjusted; commuting played a secondary role and was concentrated in the immediate hinterlands of major industrial centers. Massive rural-urban migration concentrated growth in major urban industrial cen-

¹⁸ Zelinsky, *op. cit.* [see footnote 1 above].

¹⁹ James E. Vance: Laborshed, Employment Field, and Dynamic Analysis in Urban Geography, *Econ. Geogr.*, Vol. 36, 1960, pp. 189-220.

²⁰ Among the many good descriptions of the intra-urban deconcentration process are those by Amos Hawley (The Changing Shape of Metropolitan America: Deconcentration Since 1920 [The Free Press, Glencoe, Ill., 1956]) and Leo F. Schnore (Class and Race in Cities and Suburbs [Markham, Chicago, 1972]). The example of London is described by H. Patrick White and Garth D. S. Goddard (The Development of Long Distance Commuting into London, *Geographia Polonica*, Vol. 24, 1972, pp. 95-112).

²¹ Wheeler, *op. cit.* [see footnote 17 above].

²² Leszek A. Kosiński: Urbanization in East-Central Europe after World War II, *East European Quart.*, Vol. 8, 1974, pp. 129-153.

²³ Kosta Mihailović: Regional Development Experiences and Prospects in Eastern Europe (Mouton, The Hague, 1972).

ters and led to severe housing shortages and strains on urban infrastructure and services.

The urban crisis, created by rapid industrialization and large-scale migration, forced government planners to reexamine their options. One possibility would have been to continue to concentrate industrial investments in the larger cities and industrial nodes but to divert a greater share of investment funds to the "nonproductive" sectors of urban housing, services, and social overhead capital. This approach would have resulted in a slower rate of industrialization and economic development and therefore would have been contrary to the main objectives of the centralized economies. An alternative option, to disperse a greater share of industrial capital investments to smaller cities, would have given the advantage of available local housing, urban infrastructure, and labor supplies. In addition to the obvious advantages this option offered political benefits, for it would have further reduced regional differences in levels of development and industrialization. Its complete adoption, however, was impractical because of technical linkages in highly integrated industries and because the sacrifice of agglomeration economies and economies of scale would also have resulted in decreased growth rates.

The policy to emerge was an amalgamation of the two options that leaned more to the second. A greater degree of industrial dispersion was achieved, particularly for labor-intensive and footloose industries, but development of capital-intensive industries continued in existing larger industrial centers and cities.²⁴ In addition, indirect measures, such as limitations on new housing stock and housing allocation policies, and direct administrative and legal control measures that restricted in-migration to selected cities were implemented in order to control the growth of resident population of larger urban centers.²⁵

The cumulative effect of these policies permitted continued industrialization, along with related changes in the employment structure away from the primary sectors to the secondary and tertiary sectors, but did not require commensurate urbanization and its attendant capital and operating costs (Table II). Although urban growth continued, much was diverted to smaller and intermediate-sized cities. Considering the marked structural employment changes, rural populations were maintained at surprisingly stable levels from 1960 to 1970. Most countries registered relatively small decreases: the Soviet Union from 108,403,000 to 104,873,000; Czechoslovakia from 5,847,000 to 5,410,000; the German Democratic Republic from 4,821,000 to 4,487,000; and Hungary from 5,836,000 to 5,622,000. Rural population in Poland

²⁴ F. E. Ian Hamilton: Changes in the Industrial Geography of East Europe Since 1940, *Tijdschr. voor Econ. en Soc. Geogr.*, Vol. 61, 1970, pp. 300-305.

²⁵ The limitations on housing stock are evident from the fact that new housing construction has consistently lagged behind household formation in Eastern Europe and the proportion of total capital investments devoted to new housing has actually declined in each of the countries since 1960 (Henry Morton: Housing Problems and Policies of the Comecon Countries of Eastern Europe [a paper presented at the Eighth National Convention of the American Association for the Advancement of Slavic Studies, St. Louis, Mo., Oct. 8, 1976], p. 17; and Willard S. Smith: Housing in the Soviet Union—Big Plans, Little Action, in *Soviet Economic Prospects for the Seventies* [U.S. Govt. Printing Office, Washington, D.C., 1973], pp. 404-426). Assignment of state-subsidized housing in theory proceeds according to need criteria and established norms but in practice appears biased in favor of preferred groups (Morton, *op. cit.* [see above], p. 24; and Karel J. Kinsky: Urbanization Under Socialism: The Case of Czechoslovakia [Praeger, New York, 1976]). Administrative and legal control measures may include internal passports, police registration and residence permits, and work permits and other forms of job controls and assignments (Roland J. Fuchs and George J. Demko: Spatial Population Policies in the Socialist Countries of Eastern Europe, *Soc. Sci. Quart.*, Vol. 58, 1977, pp. 60-73).

actually increased, from 15,394,000 to 15,574,000.²⁶ The maintenance of such large rural populations in spite of concurrent shifts in employment to the secondary and tertiary sector was made possible by the increase in commuting, which permitted the employment of a growing proportion of the rural labor force in nonagrarian activities.

The net impact of the policy of industrialization with "underurbanization" was to diminish and direct migration and to induce the substitution for migration of commutation, much of it involuntary.²⁷ The primary reasons for adopting policies to diminish

TABLE II—EMPLOYMENT STRUCTURE OF EASTERN EUROPEAN COUNTRIES BY PERCENT OF TOTAL EMPLOYMENT, 1950, 1960, AND 1970

COUNTRY	PRIMARY EMPLOYMENT (Agriculture and forestry)			SECONDARY EMPLOYMENT (Industry and construction)			TERTIARY EMPLOYMENT (Transportation, communications, trade, and others)		
	1950	1960	1970	1950	1960	1970	1950	1960	1970
Czechoslovakia	38.6	25.9	18.3	36.3	45.6	46.2	25.1	28.5	35.5
German Democratic Republic	27.3	17.3	13.0	43.7	48.3	49.8	28.7	34.0	36.9
Hungary	50.6	38.9	26.2	23.3	34.0	43.7	26.1	27.1	30.1
Poland	54.0	44.2	35.8	26.2	32.2	36.9	18.3	21.5	27.3
Soviet Union	47.6	38.7	26.8	27.5	32.3	37.1	27.7	28.0	35.2

Source: *Statisticheskii Yezhegodnik* [see text footnote 26], pp. 377-380.

migration and to promote commuting were evidently to reduce and defer urbanization costs. In the process some costs of development were transferred from the state to the commuters, in the sense of lost time and of lack of access to such urban amenities as state-subsidized housing and the superior cultural, educational, medical, and retail services found only in larger cities. Although creation of a more locationally balanced urban and industrial network remained the ultimate goal, commuting emerged as a policy to limit costs of urbanization in the short and intermediate terms.²⁸

CHARACTERISTICS OF COMMUTING

The substitution of commuting for migration reflects the unique political and economic circumstances of postwar Eastern Europe and differs markedly from the transition process as it occurred earlier in North America. When such commuting characteristics as vehicle mode, distances, and commuter composition are examined, it is apparent that we are dealing not only with a different form of the mobility transition but with one that has had results different from those in North America.

Commuters in Eastern Europe, in sharp contrast to those in North America, depend on public transportation. This is hardly surprising given the low levels of private ownership of automobiles. "It has been estimated that, for Warsaw, only three

²⁶ *Statisticheskii Yezhegodnik Stran-chlenov Sovyeta Ekonomicheskoy Vzaimopomoshchi—1971* (Statistical Yearbook of the Member Countries of the Council of Mutual Economic Assistance—1971), Sovyet Ekonomicheskoy Vzaimopomoshchi [Council of Mutual Economic Assistance], Moscow, 1971, p. 10.

²⁷ It should be recognized that commuting in many cases may be voluntary and preferred, such as in the case of many Polish farmers who wish to retain the small family farm (Dyzma Gataj: Part-Time Farmers, *Polish Perspectives*, Vol. 18, March, 1975, pp. 9-14).

²⁸ Socialist authorities cite other benefits derived from commuting, such as the gradual diffusion of urban influences and values to the rural areas and the "painless" adaptation of rural workers to urban life (Polsky, Taborisskaya, and Chapek, *op. cit.* [see footnote 4 above]).

percent of the commuters use their own source of transportation; and, of those to Katowice, only 12 percent use private means."²⁹ In towns of the Soviet Union, more than 90 percent of the commuter movements are accomplished by means of public transport.³⁰

Commuting in Eastern Europe, in spite of its recentness and its reliance on public transportation, is conducted over large and growing laborsheds and involves substantial travel time. In the German Democratic Republic, "the regions characterized by intense commuting usually extend to a distance of a 40-minute journey and in the case of large towns to anything up to 60 minutes or possibly to the terminus of a direct rail or bus connection."³¹ In 1970 in cities with more than a million inhabitants in the Soviet Union, 66.6 percent of commuters spent more than an hour in travel time daily, 24.7 percent more than an hour and a half, and 6.0 percent more than two hours.³² In Hungary, which as a nation represents perhaps the extreme case, 35 percent of all commuters have one-way journeys of more than an hour, and one in four commuters is absent from his home between twelve and fourteen hours a day.³³ These long commuting times result from the extended distances traveled and the overburdened and slow public transportation system.³⁴

A significant feature in the patterns of long-distance commuting in many of the Eastern European countries is weekly or longer-interval commuting. The commuter may live during the workweek at a dormitory or hostel near his place of employment and return on a weekly or monthly basis to his distant domicile. Such long-distance weekly or monthly commuting is particularly characteristic of Hungary, which has "around 300,000" such commuters,³⁵ but is apparently also common among Polish and Slovak peasant-workers.

Published findings suggest that Eastern European commuters are typically young, male, and manual or low-skilled laborers. A 1967 survey of commuters in two Soviet cities revealed the travelers to be heavily male, and more than three-quarters were under forty years of age.³⁶ Another Soviet survey of commuters showed that more than 80 percent were industrial workers, that 1 percent or fewer had a college education, and that average incomes were lower than those of city dwellers.³⁷ A study of Hungarian commuters in the 1960's found that 81 percent were male, that 73 percent were under the age of forty, and that 86 percent were manual laborers.³⁸ A more

²⁹ Gerald Karaska: Perspectives on the Less Developed Regions in Poland, in *Development Regions in the Soviet Union, Eastern Europe and Canada* (edited by Andrew F. Burghardt; Praeger, New York, 1975), pp. 43-64, reference on p. 60.

³⁰ B. S. Khorev and V. M. Moiseyenko, eds.: *Migratsionnaya Podvizhnost' Naseleniya v SSSR* [Migration Mobility of the Population in the USSR] (Statistika, Moscow, 1974), p. 120.

³¹ Frankdieter Grimm, Rudolf Kroenert, and Heinz Luedemann: Aspects of Urbanization in the German Democratic Republic, in *National Settlement Strategies: East and West* (edited by Harry Swain; IIASA, Laxenburg, Austria, 1975), pp. 74-85, reference on p. 81.

³² Khorev and Moiseyenko, *op. cit.* [see footnote 30 above], p. 117.

³³ Urban Demography [see footnote 10 above], pp. 13-14.

³⁴ See F. Sipka: Geographical Aspects of the Coming to Work in the Region of Liptov, *Acta Geographica Universitatis Comenianae, Economico-Geographica*, Vol. 9, 1970, pp. 121-156.

³⁵ György Enyedi: Development Regions in the Hungarian Great Plain in *Development Regions in the Soviet Union, Eastern Europe and Canada* [see footnote 29 above], pp. 65-74, reference on p. 69.

³⁶ Khorev, Smolina, and Vishnevskiy, *op. cit.* [see footnote 9 above], p. 107.

³⁷ B. S. Khorev, T. K. Smolina, and N. G. Sominskaya: Commuting Patterns in the Suburban Zones of Small and Middle-Size Towns, *Soviet Geography*, Vol. 14, 1973, pp. 24-33.

³⁸ B. Sárfalvi: Various Mechanisms of Internal Migration in Hungary, in *Research Problems in Hungarian Applied Geography* (edited by B. Sárfalvi; Akadémiai Kiadó, Budapest, 1969), pp. 139-149, reference on p. 145.

recent Hungarian study revealed that almost 40 percent of all "economically active" men, but only 30 percent of the women, commuted. The same study showed that only 33 percent of the country's skilled labor commuted, compared with 41.8 percent of the unskilled labor.³⁹

Because commuters in Eastern Europe are mainly young, male, and unskilled workers, they obviously do not constitute a representative cross-section of the labor force. The high proportion of unskilled workers among Eastern European commuters represents a major contrast to North America, where commuter composition is dominated by white-collar, managerial, or professional workers who typically commute greater distances than blue-collar and manual laborers.⁴⁰

PROBLEMS OF SOCIALIST COMMUTING

The transition from migration to commuting, though temporarily expedient, has given rise to a new set of problems associated with the current magnitude and scope of commuting. The great expenditures of time imposed on so many workers in their journeys to work result in "transportation weariness," which leads to lowered work productivity and limits the opportunities of commuters to participate in social, recreational, and political activities.⁴¹ Indirect effects, including a decline in social discipline, an increase in crime, and disruption of a normal family life, have also been noticed.

At the same time, the rapid increase of commuting in the 1960's and 1970's has placed great strain on the heavily subsidized public transportation systems and has required diversion of capital funds to improve the road and rail networks and to acquire additional bus and railway rolling stock. It has also imposed a considerable increase in annual operating costs. In 1970, it was estimated that each additional commuter in Warsaw required an additional investment of 15,000 zloty in capital costs and an annual increment of 1,500 zloty in operating costs.⁴²

Another serious problem associated with commuting is its unintended impact on physical planning. In Poland it is seen as leading to "a chaotic growth of residential housing along transport routes"⁴³ and in Hungary to overcrowded and underserved dormitory satellites, such as those in the Budapest agglomeration.⁴⁴

Commuting may also lead to unintended effects on the economies of the source areas of commuters. In Poland, Hungary, and Czechoslovakia the majority of the commuters are rural residents recently drawn into the urban labor force from agriculture. The agricultural economy, which has been left in the hands of an aging and predominantly female labor force, is thus disrupted.⁴⁵

³⁹ Urban Demography [see footnote 10 above], p. 12.

⁴⁰ Maurice H. Yeates and Barry J. Garner: *The North American City* (Harper and Row, New York, 1971), pp. 411-412. However, the recent trend toward decentralization within American metropolitan regions, particularly of low-skill jobs, has served to increase the length of work trips for blacks to the point where their average journey may now be longer than that of whites (Wheeler, *op. cit.* [see footnote 17 above], p. 63).

⁴¹ B. S. Khorev: *Problemy Gordov* [Problems of Cities] (Mysl', Moscow, 1975), p. 350.

⁴² Khorev, Smolina, and Vishnevskiy, *op. cit.* [see footnote 9 above], p. 108.

⁴³ Tadeusz Mrzyglód: *Economic Map 1944-1969, Polish Perspectives*, Vol. 12, November, 1969, pp. 10-22, reference on p. 15.

⁴⁴ Urban Demography [see footnote 10 above], p. 16. However, poor housing conditions also exist for city residents living in factory hostels or renting rooms in apartments (Leslie Dienes: *The Budapest Agglomeration and Hungarian Industry: A Spatial Dilemma*, *Geogr. Rev.*, Vol. 63, 1973, pp. 356-377, reference on p. 362).

⁴⁵ Pivovarov, *op. cit.* [see footnote 16 above], p. 120.

Because commuters are "largely peasants restratified as workers for eight hours a day," a potentially serious problem of social justice has also arisen.⁴⁶ This "new working class," created through involuntary commuting, is deprived of urban housing, cultural facilities, and educational services, which in effect have become reserved for those who earlier migrated to the cities or for white-collar, technical, or administrative workers. These latter groups have become a privileged class with access to publicly subsidized state housing, to cultural amenities, and to other advantages of residence in major urban centers.⁴⁷ The commuters also find that their children are denied access to the better educational facilities, which are in the major urban centers, raising the possibility that group disadvantages will be perpetuated.

"Irrational" forms of cross-commuting have become common. Examples include Moscow, where 100,000 of the city's 600,000 commuters originate in Moscow and go out to the hinterland,⁴⁸ Warsaw, which in 1969 had 140,600 in-commuters and 17,200 out-commuters,⁴⁹ and Hungary, where "approximately 150,000 such 'reverse commuters,' or nearly 15 percent of the commuters in the country, . . . live in the city and commute to rural settlements."⁵⁰ The out-commuters in the case of Moscow are largely "highly skilled workers and employees of unique institutes" and in the case of Hungary are "white-collar workers." This pattern represents a striking difference from that of North America, where out-commuters are more typically the disadvantaged urban groups.⁵¹ Cross-commuting makes apparent the existing biases in urban housing allocation in favor of the more skilled and advantaged members of the Socialist societies.

THE FUTURE OF COMMUTING AND THE MOBILITY TRANSITION IN EASTERN EUROPE

Western observers who view the burgeoning automobile ownership in Eastern Europe speculate that Eastern Europe is fated to retrace the Western experience.⁵² Such a conclusion ignores the determination of socialist planners to develop urban forms distinctive to socialism. The traditional socialist planning view holds that the current patterns are transitory and will be replaced over time by urban patterns in which residences are closer to work places.⁵³ The establishment of new urban patterns presumably will be accomplished by increasing housing stock in urban centers and by further dispersing industry. Accordingly, commuting will decline sharply in the

⁴⁶ György Konrád and Iván Szelényi: *Social Conflicts of Underurbanization*, in *Urban and Social Economics in Market and Planned Economies*, Vol. 1 (edited by Alan A. Brown, Joseph A. Licardi and Egon Neuberger; Praeger, New York, 1974), pp. 206-226, reference on p. 223.

⁴⁷ Dienes, *op. cit.* [see footnote 44 above], p. 363.

⁴⁸ V. G. Gluskova and V. A. Kopilov: *Interaction of Large Metropolitan Cities with Their Suburbs* (A Case Study of Moscow), in *Geography of Population* [see footnote 4 above], pp. 266-269, reference on p. 267.

⁴⁹ Anton Rajkiewicz: *Problems of Social Policy, Polish Perspectives*, Vol. 13, December, 1970, pp. 15-25, reference on p. 19.

⁵⁰ György Enyedi: *Rural Transformation in Hungary*, in *Rural Transformation in Hungary* (edited by G. Enyedi; Akadémiai Kiadó, Budapest, 1976), pp. 9-26, reference on p. 19.

⁵¹ Wheeler, *op. cit.* [see footnote 17 above], p. 63.

⁵² *Urban Demography: Past Developments and Projections*, *Eastern Europe*, No. 3, Radio Free Europe, 1974, p. 14.

⁵³ See Juliusz Goryński: *The Nature and Character of the Urbanization Process*, in *Problems of Regional Economic Development* (Polish Scientific Publishers, Warsaw, 1970), pp. 129-150, reference on p. 141.

future and will be replaced by migration.⁶⁴ This view, however, ignores agglomeration efficiencies and the fact that some commuters, particularly those who work in smaller cities, have come to prefer a life-style combining an urban job with a rural residence and would not willingly migrate to industrial centers.⁶⁵

Quite another view of the future is expressed by the considerable number of socialist geographers and planners who have proposed and projected the future development of unified settlement networks.⁶⁶ Unlike the fairly self-sufficient, multi-functional settlements projected by the more traditional planners, the unified settlement networks would be composed of highly interdependent settlement nodes and tributary satellities in which each center may have more specialized functions. Continued high rates of circulation, not only for work but also for cultural and service trips, would be necessary. However, unlike the current situation, the networks would provide for more rational and efficient movements and for the elimination of excessively long trips and cross-commuting. Interurban commuting would become more prevalent than rural or village to city commuting,⁶⁷ and commuting would be likely to increase and to further substitute for migration.⁶⁸

The weight of opinion by socialist planners currently favors the creation of unified, interdependent settlement systems. National space economies would become further integrated through a higher degree of communication between centers in the urban hierarchy, and distinctions between town and country would be eroded as each area came under the influence of urban fields.⁶⁹ If this view of the future prevails, commuting and circulation levels in Eastern Europe will remain high and, indeed, will increase, but the purpose and character of circulation will have changed radically from those that prevail at present.

THE MOBILITY TRANSITION HYPOTHESIS REEXAMINED

In the postwar years the nations of Eastern Europe have experienced major changes in mobility patterns. Total migration rates have declined as alternative forms of circulation, especially commuting, have increased. Superficially this general pattern conforms to the stages of Zelinsky's mobility transition hypothesis. When the pattern is examined in greater detail, however, substantial departures from Zelinsky's hypothesis emerge. The abrupt decline of migration and the rapid rise of commuting, the continued complexity of directional flows, the declining migration distances, and the apparent overlapping of mobility stages are not anticipated by the hypothesis and are the evident results of government policies in industrialization, housing, and

⁶⁴ See Polsky, Taborisskaya, and Chapek, *op. cit.* [see footnote 4 above], p. 200.

⁶⁵ For example, a study of commuters to Plock, Poland, revealed that "40 percent had no desire to move to town" (Rajkiewicz, *op. cit.* [see footnote 49 above], p. 19).

⁶⁶ See, for example, David G. Khodzaev and Boris S. Khorev: The Concept of a Unified Settlement System and the Planned Control of the Growth of Towns in the USSR, *Geographia Polonica*, Vol. 27, 1973, pp. 43-52; Peter Korcelli: Aspects of Polish National Urban Policy, in *National Settlement Strategies* [see footnote 31 above], pp. 49-69; and Grimm, Kroenert, and Luedemann, *op. cit.* [see footnote 31 above], p. 3.

⁶⁷ Macka, *op. cit.* [see footnote 12 above].

⁶⁸ See Polsky, Taborisskaya, and Chapek, *op. cit.* [see footnote 4 above], p. 200; V. M. Moiseyenko, I. I. Sorochinskaya-Goryunova, and R. V. Tatevosov: The Basic Laws Governing the Population Migration in the USSR, in *Geography of Population* [see footnote 4 above], pp. 64-67, reference on p. 66; and S. N. Rakovsky: Scientific and Technological Revolution and the Migration of Population, in *ibid.*, pp. 72-74, reference on p. 73.

⁶⁹ For a remarkably similar view of the future American settlement pattern see Brian J. L. Berry: The Geography of the United States in the Year 2000, *Transactions, Inst. of Brit. Geogr.*, Vol. 51, 1971, pp. 22-53.

urbanization. Direct government intervention in the mobility process through various control measures has also been introduced at earlier stages than the Future Super-advanced Society hypothesized by Zelinsky.

Detailed review of the characteristics and consequences of the transition from migration to commuting also reveals substantial differences from the effects of the transition in North America. Commuters in Eastern Europe, in contrast to those of North America, are largely recent agricultural workers recruited for the urban labor force as manual or low-skilled workers who, because of housing shortages, are denied urban residence. Commuter composition and lengthy commuting distances in Eastern Europe have resulted in unintended but serious social problems.

Designed as a highly generalized, "soft-focus" model describing historical change in types of mobility, the Zelinsky hypothesis is a most useful pedagogical and heuristic contribution. It has serious limitations as a geographical research paradigm, however. It fails to treat explicitly the factors that cause mobility change, it is largely aspatial in that it treats mobility without reference to changing patterns of population and settlement distribution, and it does not accommodate mobility characteristics and consequences which may be socially far more important than the superficial changes in mobility types.

The limitations of the hypothesis evident in its attempted application to Eastern Europe are likely to be confirmed in detailed studies of mobility transition in other societies.⁶⁰ Rather than a universal mobility transition, we will probably find that processes specific to individual cultures and societies have resulted in different forms of mobility transition that defy generalization in a single stage-type model.⁶¹

⁶⁰ In reviewing the relationship of circulation to urbanization in Africa and the Pacific, the applicability of the mobility transition hypothesis has been questioned by Murray Chapman and R. Mansell Prothero: *Circulation Between Home Places and Towns: A Village Approach to Urbanization* (a paper presented at the annual meeting, Association for Social Anthropology in Oceania, Monterey, Calif., March 2-6, 1977).

⁶¹ A somewhat similar conclusion has been reached by Brian Berry in regard to the urbanization process. In disavowing urbanization as a universal process he notes that "we are dealing with several fundamentally different processes that have arisen out of differences in culture and time" and that "these processes are producing different results in different world regions, transcending any superficial similarities" (Brian J. L. Berry: *The Human Consequences of Urbanization* [St. Martin's Press, New York, 1973], p. xii).

PLANNING LENINGRAD*

DENIS J. B. SHAW

THROUGHOUT the Western world planners are deeply concerned about the apparent inability of industrialized societies to cope with the social implications of continuing economic growth. At least part of this crisis consists in the struggle to maintain the city as a viable economic unit while keeping it fit for human habitation—a struggle that many Western cities are losing.¹ The experience of the Soviet Union, based on an economy so different from those of the West, is therefore of special interest. In theory a centrally planned economy allows planners to exercise much tighter control over events than that which is possible under a less restricted system and, hence, to avoid some of the pitfalls of Western urbanism. Using Leningrad as an example, I shall examine this thesis and consider Soviet experience with the problems of comprehensive planning as a whole.

ST. PETERSBURG

The special character of Leningrad derives from its founding in the early years of the eighteenth century as Russia's new capital on the marshy delta of the Neva River. Peter the Great saw his creation as a means whereby Western ideas and technology could be imported into his backward realm. From its earliest years, therefore, the city was European in both conception and design, with a strongly utilitarian orientation as a port, a naval base, a commercial center, and a major industrial node. The Tsar was by no means blind to the importance of symbolism, however, and in his time the capital was already dominated by the spires of the Peter-Paul Fortress and the Admiralty.² The latter was to become the symbolic focus of the city, the center from which the major streets, Nevskiy Prospekt, Gorokhovaya, and Voznesenskiy Prospekt, radiated (Figs. 1 and 2). But it was Peter's successors, especially Elizabeth (1741–1762), Catherine II (1762–1796), and Alexander I (1801–1825), who transformed St. Petersburg into a capital of world importance and beautified it with the architecture of Rastrelli, Quarenghi, Rinaldi, and Rossi and with the sculpture of Falconet and Klodt. From the middle of the eighteenth century a succession of buildings—the Winter Palace and the General Staff Buildings around the monumental Palace Square, the Anichkov Palace on Nevskiy Prospekt, the cathedrals of Kazan and St. Isaac, and many others—gave to the city the necessary imperial grandeur. The effect was completed by a ring of summer palaces and estates in the countryside to the south and southwest of the city. In this way St. Petersburg combined an imperial aura with an industrial and commercial character that contrasted strongly with other artificial capitals.

Even before industrialization St. Petersburg was the home of thousands of artisans and workers. The Industrial Revolution, however, which began to sweep Russia late

* I wish to thank Pat Short and Jean Dowling of the Drawing Office, Department of Geography, University of Birmingham, who drew the maps.

¹ See for example R. Goodman: *After the Planners* (Penguin Books, Harmondsworth, Middlesex, 1972).

² S. P. Luppov: *Istoriya stroitel'stva Peterburga v pervoy chetverti XVIII veka* [History of the Building of Petersburg in the First Quarter of the Eighteenth Century] (Izdatel'stvo Akademii Nauk SSSR, Moscow-Leningrad, 1957), Fig. 10.

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in the nineteenth century, added many new activities to the original port-oriented industries of the capital.³ It was accompanied by a massive expansion of population—from 540,000 in 1865 to more than 2,000,000 by 1914. The city center, bounded by the Fontanka Canal, was surrounded by industrial and workers' suburbs: to the north Vasil'yevskiy Island, Peterburgskaya and Vyborgskaya quarters, to the east and southeast Rozhdestvenskaya and Alexandro-Nevskaya quarters, and to the south and southwest Narvskaya and Moskovskaya quarters (Fig. 1).

On the eve of World War I, therefore, St. Petersburg had an extremely polyglot character. On the periphery of the city, in the industrial and workers' quarters, living conditions in the crowded and unhealthy tenements were reminiscent of the worst aspects of the Industrial Revolution in England at an earlier period. By contrast, such districts as Liteynaya and many of the central city wards were among the most fashionable in the city, well located for accessibility to governmental and commercial districts.⁴ Here, as always, the dominating buildings were those belonging to the court and higher aristocracy, the various agencies of government, the military, and the church. In addition, St. Petersburg by 1914 was reminiscent of the most sophisticated Western capitals. Banks and finance houses, shops and offices, foreign embassies, fashionable international hotels, clubs, theaters, and restaurants lined its better streets, notably Nevskiy Prospekt and Morskaya (Fig. 2).⁵ All this, however, could not hide the city's underlying squalor.

EARLY LENINGRAD

The declaration of war by Germany on Russia in 1914 ushered in a decisive period in the history of St. Petersburg (known after August, 1914, as Petrograd and renamed Leningrad in 1924). The long years of war strained the economic and social fabric of the capital and led to the revolutions of March and November, 1917. The ensuing civil war led to chaos and famine. The population of the city fell catastrophically to 830,000 in 1921, and not until the end of the decade did it regain its prewar level. The war and the revolutions had a major impact on industrial and commercial life. Even more significant, however, were the political and social policies pursued by the new Bolshevik government. After March, 1917, the social pyramid, which had been based on the aristocracy, collapsed. A year later, in March, 1918, the Bolsheviks transferred the capital back to Moscow. The ministries and governmental agencies disappeared, and foreign interests and many commercial and industrial corporations were soon nationalized. The social revolution led to the emigration of many merchants, politicians, and intellectuals. The city center was transformed, as buildings that had formerly served the court and ministries were put to new economic or political uses, and as part of the population living in poorer peripheral districts were allocated more comfortable quarters in the center.⁶

In the difficult years between World Wars I and II the Soviet government empha-

³ Ye. Lopatina: *Leningrad: Ekonomiko-geograficheskiy ocherk* [Leningrad: *Economic-geographical Synopsis*] (Gosudarstvennoye izdatel'stvo geograficheskoy literatury, Moscow, 1959), pp. 59-92; and V. V. Pokshishevskiy: *Territorial'noye formirovaniye promyshlennogo kompleksa Peterburga v XVIII-XIX vekakh* [Territorial Formation of the Industrial Complex of Petersburg in the Eighteenth and Nineteenth Centuries], *Voprosy Geografii* (*Problems of Geography*), No. 20, 1950, pp. 122-162.

⁴ James H. Bater: *St. Petersburg* (Edward Arnold, London, 1976), pp. 308-382.

⁵ Karl Baedeker: *Russia with Teheran, Port Arthur and Peking: Handbook for Travellers* (Karl Baedeker, Leipzig, 1914), pp. 85-178.

⁶ Lopatina, Leningrad [see footnote 3 above], pp. 93-114.

ST. PETERSBURG IN 1914

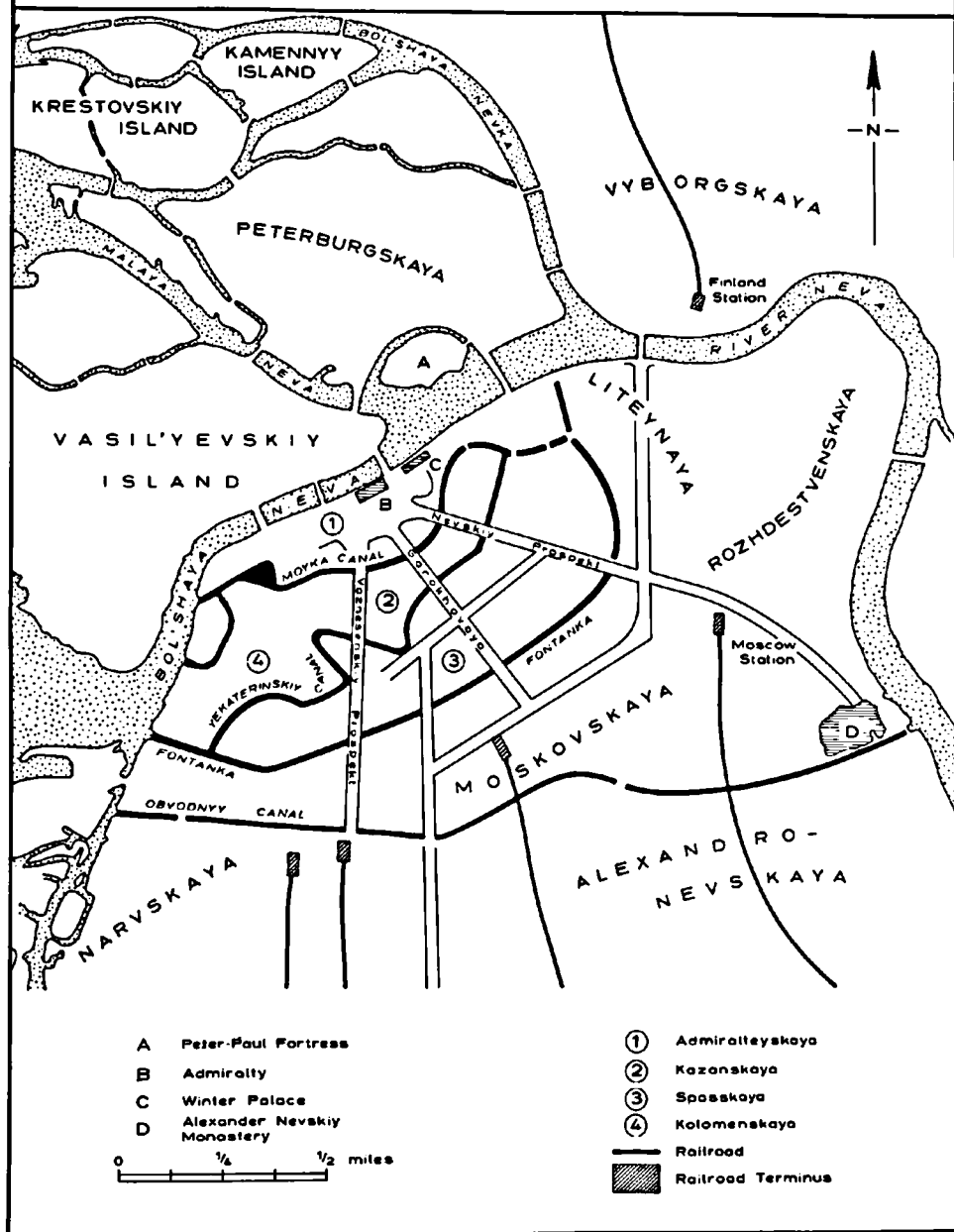


FIG. 1—St. Petersburg and its suburbs in 1914.

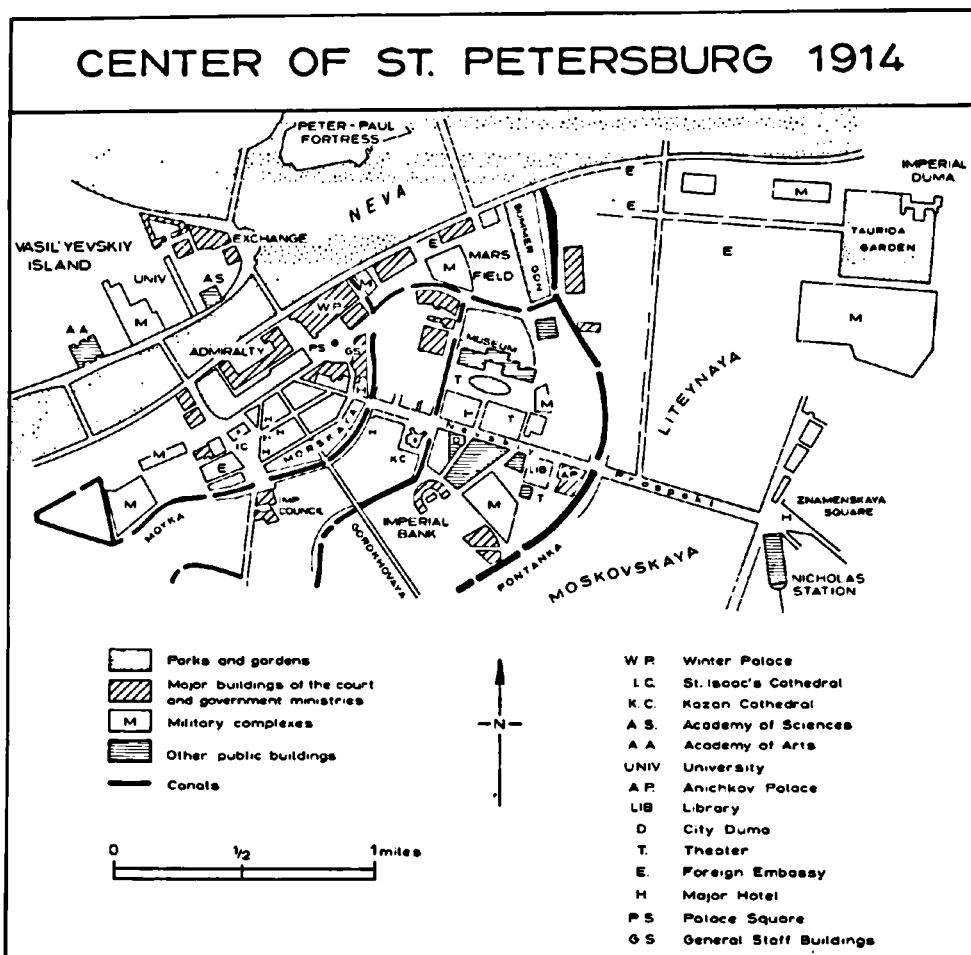


FIG. 2—The center of St. Petersburg in 1914.

sized recovery from the effects of the revolution and civil war, rapid industrialization, and militarization. Established industrial cities such as Leningrad had to play a full part in the new economic program, reequipping their industry and investing in the latest technology.⁷ Little capital was available for urban improvement, and housing and related infrastructure deteriorated. Hence between 1913 and 1939, when the overall population increased from 2.1 to more than 3 million, the amount of general living space in Leningrad grew only from 21.8 to 25.7 million square meters.⁸ To counteract the problems of overcrowding, a plenary session of the Communist Party decreed in June, 1931, that new industrial plants were to be channeled away from the city. A city plan, based on the pioneering Moscow Plan, was promulgated on August 10, 1935. The necessity of a formidable program of urban improvement was under-

⁷ *Ibid.*

⁸ "Leningrad i Leningradskaya oblast' v tsifrakh [Leningrad and Leningrad Province in Figures]" (Lenizdat, Leningrad, 1974), p. 149. Soviet planners distinguish between general living space, which includes kitchens, bathrooms, and so forth, and housing space, which includes only bedrooms, living rooms, and the like. The figures above refer to the former. The statistic of 25.7 million square meters of living space refers to 1940.

lined. Further development of the transportation network of the city, the reconstruction and development of residential areas, and the provision of services, parks, and recreation areas were envisaged. Some slum areas were actually cleared away and the construction of new apartments begun, especially in the southern industrial suburbs. Implementation of the plan was cut short, however, by World War II.

The devastating impact of the war on Leningrad is well known. During the 900-day siege some 650,000 people lost their lives, and large numbers were evacuated. Some 3,000 buildings were destroyed and more than twice that number were severely damaged.⁹ Fortunately, few of the architectural treasures of the city center were damaged irretrievably, but the destruction at the front—at such places as Pushkin (Tsarskoye Selo) and Petrodvorets (Peterhof)—was particularly extensive.

The postwar era was devoted to reconstructing the city's productive capacity and to restoring damaged housing. Not until the early 1960's did Leningrad recover its prewar population, and not until then was capital available in sufficient quantity to revive the prewar program of urban improvement. The basic guidelines for this program were laid down in a new city plan, which was approved by the Soviet of Ministers on July 15, 1966.¹⁰ Now that twelve years have passed, it is appropriate to examine the central precepts of the plan and to assess the degree of its success.

THE PRESENT AND THE PROSPECTS

The 1966 plan sets out the principles that are to guide the growth of the city until about 1990 and the means to maintain and enhance the role of Leningrad as "one of the country's leading centers of scientific and technical progress."¹¹ The plan specifies the need to develop the city still further in the direction of socialist goals while preserving the best from the past, and the necessity of controlling the further growth of population is particularly stressed. I shall examine several facets of the planning of Leningrad: industry and the port; housing, transportation, and suburban development; culture, services, and amenities; urban conservation; and the city's environs.

INDUSTRY AND THE PORT

After Moscow, Leningrad is regarded as the most important base for advanced technology and production in the Soviet Union. The plan provides for Leningrad's continued industrial development; however, for environmental reasons and for reasons of regional planning, this development is to take the form of further industrial efficiency and intensification rather than of large-scale expansion. Care is also to be exercised that the expansion of Leningrad's traditional maritime and inland port facilities takes place within controlled limits.

The industrial development of Leningrad in Soviet times has been impressive, and commensurate with the development of the Soviet Union as a whole. The value of overall industrial production in 1973, for example, was 7.5 times that of 1940, while labor productivity, or the value of average industrial production per man, increased by almost 600 percent in the same period.¹² Traditional industries, such as engineering, machine building, metallurgy, and shipbuilding, account for more than 50

⁹ "Leningrad za 50 let [Leningrad in 50 Years]" (Lenizdat, Leningrad, 1967), p. 13.

¹⁰ V. A. Kamenskiy: *Gorod smotrit v zavtra* [A City Looks Forward to Tomorrow] (Lenizdat, Leningrad, 1968), pp. 5-12.

¹¹ Leningrad za 50 let [see footnote 9 above], pp. 163-167.

¹² Leningrad i Leningradskaya oblast' [see footnote 8 above], pp. 34 and 80.

percent of production. Other important industries include electronics, chemicals, wood processing, construction and building materials, food, and printing. Local coal- and peat-fired power stations, hydroelectric power, and, increasingly, oil and natural gas provide the energy base. The industries continue to be concentrated in the ring of suburbs surrounding the city center—in the Kirov (formerly Narvskaya) and Moscow districts to the south, and in the Vyborg, Petrograd, and Vasil'yevskiy Island districts to the north. No sweeping changes are envisaged in this situation, although some relocation and amalgamation are occurring. The development of the marine port likewise involves no radical changes. The new passenger terminal on the southwestern tip of Vasil'yevskiy Island is to be expanded, however. Further growth of the river port involves the completion of two new passenger ports for river traffic, the concentration of freight traffic into two large areas with mechanized facilities, and the reconstruction of several of the Neva bridges.¹³

Implicit in the strategy contained in the 1966 plan are several difficulties that are becoming increasingly apparent in the 1970's. Industry almost inevitably means pollution, a problem by no means solved in Leningrad. The plan therefore calls for about a hundred plants and various research institutes and other activities not basic to the city's economy to be relocated to satellites well outside the built-up area. More serious is the growing transportation problem, the product both of industrialization itself, as the demand for raw materials develops, and of the increasing distance between places of employment and the burgeoning residential suburbs on the city's periphery. As a result, many of Leningrad's planners are calling for the relocation of at least some of the city's industrial capacity closer to the suburbs.¹⁴

At present it seems highly unlikely that the continuing industrialization of Leningrad can in fact be constrained within the narrow demographic limits laid down by the 1966 plan.¹⁵ Not only is population growth currently exceeding the planned rate, but there is a serious labor shortage in the city. To exacerbate the problem, not all of the central government ministries behave according to the precepts laid down by the city plan. According to M. D. Filonov, deputy chairman of the city executive committee (equivalent to the deputy mayor), some of the ministries "continue to define the future plans of industrial concerns without reference to local conditions and labor resources, and sometimes fail to utilize available capital so as to further technical reequipment, the specialization and concentration of production, and the enhancement of linkages between science and industry."¹⁶ In this way the organs of central government act against the interests of local planning, underlining a conflict that frequently occurs in Soviet urban development.¹⁷

HOUSING, TRANSPORTATION, AND SUBURBAN DEVELOPMENT

In 1951 the housing crisis in Leningrad was particularly acute. In that year there

¹³ Kamenskiy, *Gorod smotrit v zavtra* [see footnote 10 above], pp. 275–276; and V. A. Kamenskiy: *General'nyy plan Leningrada* [The General Plan of Leningrad], in *General'nyye plany krupnykh gorodov* [The General Plans of Large Cities] ("Budivel'nik," Kiev, 1967), pp. 9–20.

¹⁴ A. Yu. Belinskiy: *Poyezdki na rabotu—kak sokratit' ikh prodolzhitel'nost'*? [The Journey to Work—How Is It to Be Shortened?], *Stroitel'stvo i Arkhitektura Leningrada* (Construction and Architecture of Leningrad), No. 6, 1975, pp. 24–26.

¹⁵ The 1966 plan allows for 3.5 million people, or 4 million including the "forest-park" zone.

¹⁶ M. D. Filonov: *Ustremennost' v budushcheye* [Aiming for the Future], *Stroitel'stvo i Arkhitektura Leningrada* (Construction and Architecture of Leningrad), No. 6, 1974, p. 2. My translation.

¹⁷ See, for example, W. Taubman: *Governing Soviet Cities: Bureaucratic Politics and Urban Development in the USSR* (Praeger, New York, 1973).

were an average of 3.3 families per apartment, many of which lacked such basic facilities as bathrooms and hygienic kitchens.¹⁸ The minimum housing space per person was only 3.5 square meters, compared with 9.0 square meters accepted as standard by the Soviets today. Since the late 1950's, however, with the introduction of industrialized house-building methods (such as the large panel and block-section techniques), the provision of more finance for house construction, and the reorganization of the building industry,¹⁹ rapid progress has been made. Between 1950 and 1973 the amount of general living space in the city grew from 22.9 to 53.9 million square meters.²⁰ From 1965 to 1973, 393,000 apartments, with space equivalent to 19 million square meters, were completed.²¹ No fewer than 1.5 million people, of whom 1.25 million moved into flats in new blocks, directly benefited from this achievement. Much remains to be done, however. The ultimate aims of the 1966 plan envisage one apartment per family, one person per room. At present, however, only 47 percent of Leningrad's households occupy an individual flat.²²

Most of Leningrad's residential development is, of course, taking place in the outer suburbs, where the availability of land and a pleasant environment create an attractive milieu. By the end of this century the built-up area of the city may have doubled. Massive areal expansion is, however, attracting major criticism in view of the costs of transportation and of the necessary infrastructure. More recently, therefore, proposals have been made to increase the desirable density of residential development from 5,500 to 6,500 square meters of living space per hectare.²³ At the same time one of the principal aims of the 1966 plan is being answered in a decisively expansionistic manner. The city's "exit to the sea" is being achieved through the development of new residential suburbs and parks along boulevards to the north and south of the Gulf of Finland and on the western part of Vasil'yevskiy Island (Fig. 3). In this way it is intended to fulfill what Leningrad's planners consider to be the city's historical destiny, its establishment as a coastal city.²⁴

Commensurate with the tendency to increase the density of residential development in Leningrad is a tendency to build ever-higher blocks of apartments—up to twenty-two stories in recent times. The tallest blocks will be built on the periphery of the city, where there is little danger of a clash with the more historic quarters. At least one writer believes that blocks of ten stories or more will constitute up to 37 percent of all new residential construction by 1980.²⁵

From the point of view of housing development Leningrad is divided into fourteen "planning regions."²⁶ Each region is planned to accommodate between 200,000 and 300,000 people with a major service and shopping center. Regions are themselves

¹⁸ David T. Cattell: *Leningrad: A Case Study of Soviet Urban Development* (Praeger, New York, 1968), p. 113.

¹⁹ The first *Kombinat* or housing combine (that is, a group of organizations bound together and responsible for all aspects of housing construction) in the Soviet Union was introduced in Leningrad in 1959.

²⁰ Leningrad i Leningradskaya oblast' [see footnote 8 above], p. 149.

²¹ G. N. Buldakov: *Arkhitekturnyye ansambli novogo Leningrada* [Architectural Ensembles of the New Leningrad], *Stroitel'stvo i Arkhitektura Leningrada* (Construction and Architecture of Leningrad), No. 9, 1972, p. 2.

²² I. Yu. Murav'yeva: *S uchetom struktury naseleniya* [Considering the Structure of the Population], *ibid.*, No. 9, 1974, p. 23.

²³ V. F. Nazarov: *Etapy stanovleniya bol'shogo Leningrada* [Stages in the Development of Greater Leningrad], *ibid.*, No. 12, 1974, p. 9.

²⁴ Kamenskiy, *Gorod smotrit v zavtra* [see footnote 10 above], pp. 91–120.

²⁵ Buldakov, *op. cit.* [see footnote 21 above], p. 5.

²⁶ Kamenskiy, *Gorod smotrit v zavtra* [see footnote 10 above], p. 48.

LENINGRAD IN 1966

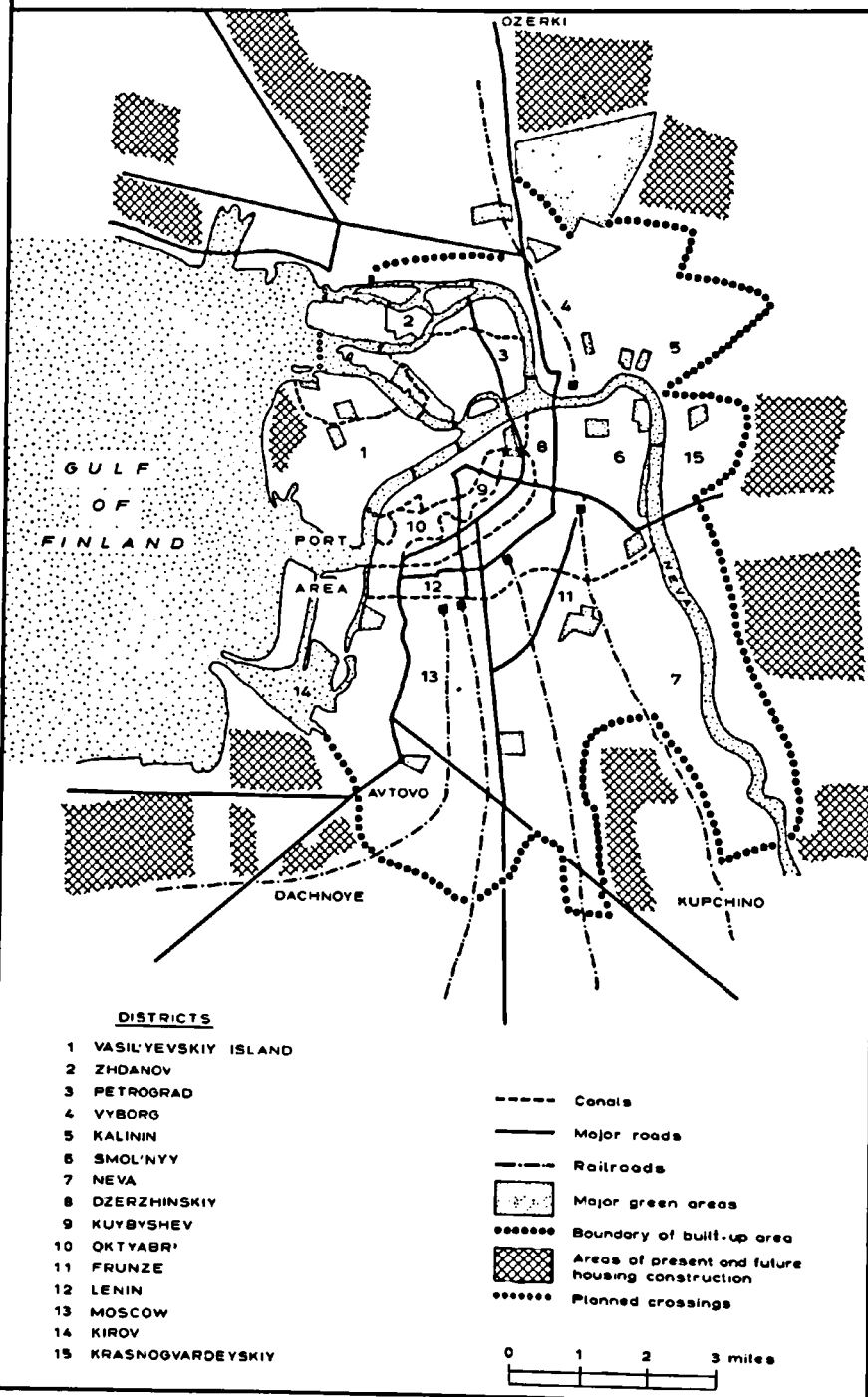


FIG. 3—Present and future expansion of the built-up area of Leningrad.

divided into a number of "residential districts," each occupying 170 to 350 hectares with a population of 25,000 to 30,000. In the residential district a lower-order service center caters largely to occasional shopping and to cultural needs. Daily needs are provided in the basic planning unit, the *mikrorayon* or neighbourhood unit, of which

TABLE I—POPULATION CHANGES IN DISTRICTS OF LENINGRAD, 1959-1967
(In thousands)

DISTRICT	1959 ^a	1967 ^a
Vasil'yevskiy Island	264	233
Vyborg	228	363
Dzerzhinskiy	211	160
Zhdanov	209	185
Kalinin	213	326
Kirov	188	316
Kuybyshev	191	146
Lenin	235	176
Moscow	189	386
Neva	177	273
Oktyabr'	279	211
Petrograd	185	146
Smol'nyy	228	178
Frunze	225	223

Source: Leningrad za 50 let [see text footnote 9], p. 23.

^a Within the boundaries of 1966.

there are six to ten in the residential district. The *mikrorayon* has a population of 2,000 to 3,000 (or may have up to 12,000 in the newer areas). It consists of a number of residential blocks surrounding play and green areas, and the basic idea is to isolate the unit from major traffic arteries. In some of the older areas of the city, however, the individual housing block provides the basic planning unit. In many of these, developed during the 1950's and early 1960's, shopping and similar facilities are provided on the ground floor. There is little need to stress that the concept of the *mikrorayon*, with its overtones of neighborliness and communal living, appeals strongly to Soviet planners bent on creating a socialist society.

The residential development of Leningrad has been accompanied by a redistribution of population (Table I). Between 1959 and 1967 the inner areas of the city—Dzerzhinskiy, Kuybyshev, Lenin, Smol'nyy, Oktyabr', and Petrograd—showed considerable population decline. The tendency has continued, so that now the population is only 66 percent of that in 1959. The major beneficiaries of this relocation are the larger families that have moved to new areas on the periphery. The result is a significant differential between the populations of the inner and the outer zones of the city: larger numbers of single people, married couples, and older people in the inner areas; more large families in the peripheral regions where bigger and individual flats are available. In the older areas of the city the reduction in population has led to an improvement in the general standards of living. It has also permitted the gradual renovation of old blocks, many of them built before the revolution, with newer services installed on the ground floor.²⁷

²⁷ M. M. Vlanina: *Osobennosti organizatsii sistemy obsluzhivaniya starykh zhilykh rayonov Leningrada* [Peculiarities in the Organization of the System of Services in the Old Residential Districts of Leningrad], in *Planirovka i zastroyka zhilykh rayonov i mikrorayonov* [The Planning and Construction of Residential Areas and Neighborhoods] ("Budivel'nik," Kiev, 1972), pp. 53-56.

Recent investigations by the institutes and planning bodies in Leningrad that are responsible for housing development have pointed out some shortcomings in housing allocation procedures in the city. One analysis of voluntary exchanges of apartments has shown that the most mobile groups are couples without children or single people.²⁸ Ye. A. Guseva claims that this demonstrates the inadequacy of provision for these groups, though a simpler explanation would be that these people find it easier to move. More serious is the revelation that among larger families the length of the

TABLE II—NUMBERS OF PASSENGERS CARRIED BY LENINGRAD
CITY TRANSPORTATION, 1950-1973
(In millions)

MODE	1950	1960	1965	1970	1973
Streetcar	860	909	790	783	786
Trolleybus	112	238	249	332	393
Bus	182	565	738	810	959
Subway	...	106	263	418	503

Source: Leningrad i Leningradskaya oblast' [see text footnote 8], p. 100.

journey to work is a major consideration in preferred residential location and that many families are prepared to tolerate a smaller flat which is more conveniently situated. This is perhaps somewhat ironical in view of the fact that the larger families are now tending to live farther from their work. Guseva concludes that more flexibility is required in allocating and exchanging flats and also pleads for the provision of more employment in the outer suburbs.

The question of the length of the journey to work is now increasingly worrying Leningrad's planners.²⁹ Socialist planning seeks to reduce such economically and socially "wasteful" practices as commuting, which leads to increased pressure on an already hard-pressed public transportation system. The number of passengers carried by Leningrad transportation vehicles more than doubled between 1950 and 1973 (Table II); and there have been similar increases in both the average length of journey and the numbers of journeys per passenger per year.³⁰ Public transportation has not developed proportionally, so overcrowding is considerable. The answer of the planners, as indicated already, is increased employment in the suburbs and more flexibility in housing allocation. More important, however, are the plans for improving transportation. These include the extension of the increasingly important subway services (Fig. 4), a great growth in the number of buses and trolleybuses accompanied by increases in route length, the development of some 61 kilometers of express streetcar routes in the suburbs, which will raise the average speed of streetcars from 16 to between 25 and 30 kilometers per hour, and the improvement of suburban rail services.³¹ Plans also provide for the further development of the network of roads, including the completion of a semicircular highway bypassing the city center and the designation of certain "fast" routes. Road development must, of course, proceed with

²⁸ Ye. A. Guseva: *Zhilishchu—raznoobraziye i gibkost'* [For the Residence—Variety and Flexibility], *Stroitel'stvo i Arkhitektura Leningrada* (Construction and Architecture of Leningrad), No. 9, 1974, pp. 19-21.

²⁹ Belinskiy, *op. cit.* [see footnote 14 above], pp. 24-26.

³⁰ The average journey to work of Leningraders who live in the newer outer suburbs is now somewhere between forty-five minutes and an hour, but for many people it exceeds an hour and a half (*ibid.*, pp. 24 and 26).

³¹ The city has many commuters from its surrounding satellites (Ye. Lopatina: *The Formation of Leningrad's Satellite Places*, *Soviet Geography*, Vol. 3, 1963, pp. 43-50).

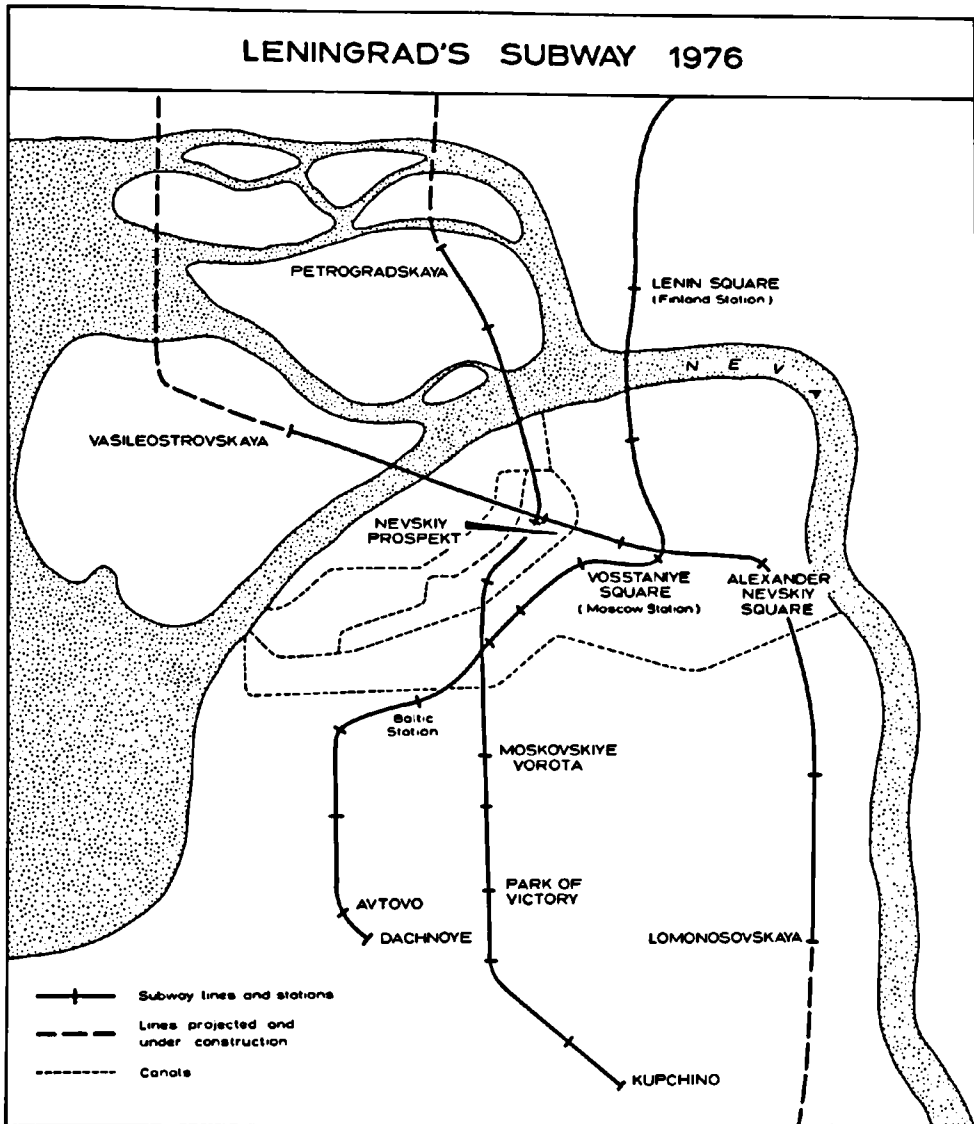


FIG. 4—Leningrad's subway system in 1976.

due regard to the conservation of the existing urban fabric. It will be interesting to see whether the planned increases in automobile production in the Soviet Union will in fact eventually force the planners to take a more radical stance on the question of highway construction in Leningrad.³²

Leningrad's suburban development therefore has wide-ranging implications for the entire urban system. The average citizen has experienced a marked increase in living standards, but much remains to be done. City authorities have recently become concerned about both the rate of progress and the cost of construction of housing. In

³² Most Soviet cities are not as yet facing the levels of traffic congestion common in the West (F. E. Ian Hamilton: *The Moscow City Region* [Oxford Univ. Press, Oxford, 1976], p. 20).

1974 the city executive committee passed a resolution to speed up the building program by introducing more efficient and economical construction techniques. It would appear that the house-building combines are too restricted in their approach and far too inflexible, while there is a perennial crisis in the building materials industry. G. N. Buldakov complains of the large numbers of suburban "white spots," where housing has been completed but roads, services, and the like are still incomplete.³³ This testifies to a lack of coordination between the various bodies responsible for suburban development. Finally, industrialization, standardization, and poor building techniques give rise to frequent complaints about the creation of urban blight.

In an article in Leningrad's official architectural journal, Ye. M. Poltoratskiy asks whether the town is a "living organism" or merely a "built-up area."³⁴ Contrasting the occasional successes of "quality" with the mass failures of "quantity," Poltoratskiy criticizes the inhumanity of much of modern architecture with its emphasis on scale, norms, and repetition. It is no more relevant, he says, to talk of mass production in town planning than it would be in art or music. In one old part of Leningrad, for example, he notes the human scale of architecture and the richness of the human environment. "I do not know how many school places there were here per one thousand inhabitants, nor whether the accepted norms for the service areas of shops were observed, but I well remember how good the bread smelled from the Filipovskoy bakery."³⁵ The dehumanization of the "concrete jungle" would thus seem to be a problem for planners in both the East and the West. In both places large-scale planning and mass construction have been seen as one answer to the overcrowded inner city. Some observers are now beginning to ask themselves whether the cure has not proved to be as bad as the disease.

CULTURE, SERVICES, AND AMENITIES

Leningrad's claim to be one of the leading centers of scientific and technical progress in the Soviet Union is based on its all-important scientific and cultural role, a role that it inherited from its prerevolutionary position as capital of the country. Today many research and development organs, foremost of which is the Leningrad branch of the All-Union Academy of Sciences, are located in the city. Forty-one higher educational and technical institutes graduate almost 40,000 students each year.³⁶ Leningrad, moreover, is heir to cultural facilities of world renown, many of which date from the prerevolutionary era: the Kirov Opera and Ballet, the Pushkin Drama Theater, the Saltykov-Shchedrin Library, the Hermitage, the Russian Museum, and others. All of these institutions will have a role to play in the new Leningrad. Two problems, however, face cultural facilities and services in general—their concentration in the city center, and the fact that they are heavily over-subscribed. Both problems are the product of long neglect by the government, and the solution lies in ambitious plans for expansion. The 1966 plan, for instance, calls for the construction of ten new theaters and concert halls (of 1,500 seats each), nine theater

³³ Buldakov, *op. cit.* [see footnote 21 above], p. 3. My translation.

³⁴ Ye. M. Poltoratskiy: *Gorod—zastroyka ili zhivoy organism?* [The City—A Built-up Area or a Living Organism?, *Stroitel'stvo i Arkhitektura Leningrada* (Construction and Architecture of Leningrad), No. 9, 1974, pp. 7–9. A rather different viewpoint was stated in G. I. Yakovlev: *Povtoryayemost' yeshche ne monotonnost'* [Repetition Need not be Monotony], *ibid.*, No. 7, 1975, pp. 42–43.

³⁵ Poltoratskiy, *op. cit.* [see footnote 34 above], p. 9. My translation.

³⁶ Leningrad i Leningradskaya oblast' [see footnote 8 above], pp. 162 and 166.

halls (seating up to 2,000 people) that can also be used for other purposes, numerous clubs, and a doubling of cinema seats.³⁷ Many of these facilities will be developed in the suburbs.

The heavy pressure on cultural facilities is paralleled in retail and general facilities. The value of consumer durables sold per head of the population in Leningrad each year is four and a half times what it was in 1940. That of perishable goods has doubled in the same period.³⁸ Retail outlets have not increased proportionally. Thus an increase of facilities in keeping with the new official emphasis on raising living standards is to take place within the hierarchical suburban scheme outlined earlier. Daily needs (kindergartens and nurseries, schools, food shops, canteens, cafes, libraries, sports facilities, and so forth) are provided for at the level of the mikrorayon, well within walking distance of the home. More specialized needs (clubs, children's pioneer clubs, cinemas, clinics, department and specialty stores, repair and maintenance services, and restaurants, for example) will be catered to at the higher levels. In the center of some planning regions will be services (including theaters, museums, and concert halls) catering to the city as a whole.

One feature of life in the Soviet Union that has received much official attention since the revolution is outdoor recreation and sport. As in the case of services in general, however, the cultivation of sports as a mass and popular activity has had to wait until relatively recently before attracting much in the way of investment. Planners lament the fact that, in consequence, sports participation tends to be low. Only 7 to 10 percent of Leningrad's adult populace, for example, are "regular" participants (whatever that may mean), and in the newer suburbs where facilities are poor and commuting problems exist, the participation rate is as low as 1 to 2 percent.³⁹ Because the Soviet aim for sports participation is about 60 percent, however, Leningrad has ambitious plans to increase the total area of land devoted to sports facilities from 350 to 1,700 hectares, to develop sports facilities at all levels from the mikrorayon upward,⁴⁰ to increase facilities for spectator sports, and to develop sports bases of All-Union significance in and beyond the forest-park zone at Kavgolovo and Orekhovo.

Sports development presupposes the provision of green spaces within the city, and indeed the "greenification" of the city is one of the basic aims of Soviet planning. In some respects Leningrad is well placed as far as parks and gardens are concerned. It has inherited many open spaces in its center from the prerevolutionary period, for example, the Admiralty garden, the Summer garden, and Mars Field (Fig. 2). Some new parks and gardens have been added in the Soviet era, and a special effort has been made to transform the islands in the delta northwest of the city—the haunts of the wealthy and the sites of many *dachas* (second homes, usually privately owned) before the revolution—into centers for recreation and sport. In 1966 plans were laid to expand the green area from 5.8 to 20 square meters per person by the end of this century, but this may now be reduced in view of more recent emphasis on intensive land use in the suburbs. Because of shorter working hours, and also of the diminutive size of many apartments, Soviet citizens tend to spend longer periods outdoors than their Western counterparts. Research into the outdoor recreational habits of the

³⁷ V. A. Kamenskiy: Leningrad: General'nyy plan razvitiya goroda [Leningrad: The General Plan of City Development] (Lenizdat, Leningrad, 1972), p. 50.

³⁸ Leningrad i Leningradskaya oblast' [see footnote 8 above], pp. 135–136.

³⁹ Yu. B. Khromov: Ob usloviyakh otdykha naseleniya [On the State of Public Recreation], *Zhizlishchnoye stroitel'stvo* (Residential Construction), No. 1, 1972, pp. 28–30.

⁴⁰ Kamenskiy, Leningrad [see footnote 37 above], p. 50.

TABLE III—RECREATIONAL CHOICES MADE BY INHABITANTS OF VARIOUS MIKRRAYONY IN LENINGRAD, 1969-1970, ON NONWORKING DAYS
(In row percentages)

MIKRRAYON	NEIGHBOR- HOOD PARKS	SUBURBAN PARKS	CITY PARKS	PARKS OUTSIDE CITY	NO VISITS
No. 17-35a, M. Thorez Prospekt ^a	33.6	17.8	7.8	29.1	11.7
No. 5, Dachnoye	51.0	1.5	7.9	22.8	16.8
No. 5 near Yu. Gagarin Prospekt	34.5	6.8	.0	33.8	16.9
Vasil'yevskiy Island	40.0	7.9	19.5	27.0	5.6

Source: Khromov, *Ob usloviyakh* [see text footnote 39], p. 30.

^a Thorez, Gagarin, and Dachnoye are situated in newer, outer suburbs. Vasil'yevskiy Island is an older inner-city district. The data are derived from a questionnaire survey of 20,000 people above the age of 16.

residents of four of the city's mikrrayony shows that local neighborhood parks and gardens and parks beyond the built-up area are heavily used, but central city parks are not well used except by the conveniently situated residents of Vasil'yevskiy Island (Table III).⁴¹ Planners should therefore recognize the need for a heavy new emphasis on both local parks and on parks beyond the city fringes.

URBAN CONSERVATION

One official publication, in outlining the provisions of the 1966 plan, describes Leningrad as a "unique phenomenon" in the history of Russian and world town planning. The townscape was formed by "generations of Russian artists," thus becoming "one of the most beautiful in the world."⁴² It becomes imperative for the sake of future society to preserve this beauty.

Soviet planning has not always adopted a conservationist attitude toward older cities. In Moscow, for example, many an architectural or historical gem has been demolished. Leningrad, on the other hand, has been remarkably diligent in preserving its prerevolutionary heritage, the major losses being some Tsarist memorials of doubtful value. The long years of Stalinist neglect may perhaps have been mainly responsible for the preservation of the townscape. Recently, however, Soviet planners have become concerned about their cultural heritage, and, though they are not afraid of modification and development in the historic core where considered appropriate (for example, on the Neva embankment and in Smol'nyy district), they have so far managed to avoid the vivid and sometimes painful clashes between old and new that occasionally characterize Moscow.⁴³ With regard to tall buildings, moreover, the decree of Tsar Nicholas I that no new building in Petersburg was to exceed the height of the Winter Palace might almost still be in force.

The major conservation problem facing Leningrad's planners is to marry a functioning commercial and residential core with a fabric that is often many decades old. The maintenance and improvement of this fabric is difficult and expensive, and there is some evidence of friction between morphology and function similar to that found in Western cities.⁴⁴ Away from the main streets, for example, many buildings show signs

⁴¹ Khromov, *Ob usloviyakh* [see footnote 39 above].

⁴² Leningrad za 50 let [see footnote 9 above], p. 165. My translation.

⁴³ Hamilton, *op. cit.* [see footnote 32 above], pp. 20-24.

⁴⁴ G. M. Vlanin: Nov' starogo tsentra [What is New in the Old Center,] *Stroitel'stvo i Arkhitektura Leningrada* (Construction and Architecture of Leningrad), No. 12, 1974, pp. 24-26.

of neglect, and in the older residential quarters renovation of the housing blocks is proceeding slowly. The available funds for renovating the central city have been channeled into the more important tourist sites.

In Soviet thinking conservation is a major task of socialism, which must avoid the commercialism of capitalism, but in the case of Leningrad it has the added value of enhancing the tourist status of the city. The maintenance of tourist facilities is therefore an additional task for the planners. Between 1965 and 1973 an additional 4,000 beds brought the total of beds available in Leningrad's nineteen public hotels up to only 11,167—hardly adequate for a city of 3.8 million people.⁴⁵

Of course, tourists visit not only Leningrad proper but also the former Tsarist parks and palaces south and west of the city, especially Pushkin (Tsarskoye Selo), Pavlovsk, and Petrodvorets (Peterhof). These places, destroyed during World War II, have been restored at enormous expense. The pressure of visitors is great, especially since the introduction of the five-day workweek in 1967 and 1968. In the case of Petrodvorets, for example, the number of visitors per summer weekend doubled between 1967 and 1968, and the fine parks are beginning to suffer in consequence.⁴⁶ Only by providing alternative recreation areas can planners hope to ameliorate this situation.

THE CITY'S ENVIRONS

Yu. B. Khromov estimates that on summer weekends approximately a third of Leningrad's citizens travel for pleasure to the green area beyond the built-up zone of the city.⁴⁷ For a population that is still relatively immobile by Western standards, because automobile ownership is even now the exception rather than the rule, this is an impressive statistic. It provides one incentive for preserving the countryside around the city intact. Other incentives include the wish to develop Leningrad into a city in which greenery represents a significant element in the urban fabric and the desire to control the indefinite expansion of the urban area.

The 1966 plan views the development of the city in the context of its regional setting. The city is surrounded by a zone of approximately 1.4 million hectares in which development is to be controlled in the interests of the central urban node. Within this suburban zone is a belt of 260,000 hectares immediately surrounding the city that constitutes a "forest-park zone." No development at all is allowed in the 50,000 hectares of this zone closest to the urban area. This will be a green zone of high-quality "forest parks" catering to the daily and short-term recreational requirements of the populace. In the remaining 210,000 hectares some recreational development will be permitted, and the plan allows for limited expansion by such towns as Pushkin, Pavlovsk, and Kolpino. The remainder of the suburban zone will experience controlled development. Facilities for long-term recreation (visits of a week or more) will be provided, especially in the verdant landscape of forests and lakes north of the city (Fig. 5).

Recent data hint at the difficulties of enforcing some of these plans. Within a

⁴⁵ Leningrad i Leningradskaya oblast' [see footnote 8 above], p. 152.

⁴⁶ Yu. B. Khromov: *Razvitiye primorskikh-rekreatsionnykh tsentrov v gruppovykh sistemakh rasseleniya* [The Development of Seaside Recreational Centers in Grouped Systems of Settlement], *Zona otdykha i ozeleneniye gorodov* (The Recreational Zone and the Making Green of Cities) (Tsentral'nyy nauchno-issledovatel'nyy i proyektnyy institut po gradostroitel'stvu, Moscow, 1973).

⁴⁷ Khromov, *Ob usloviyakh* [see footnote 39 above].

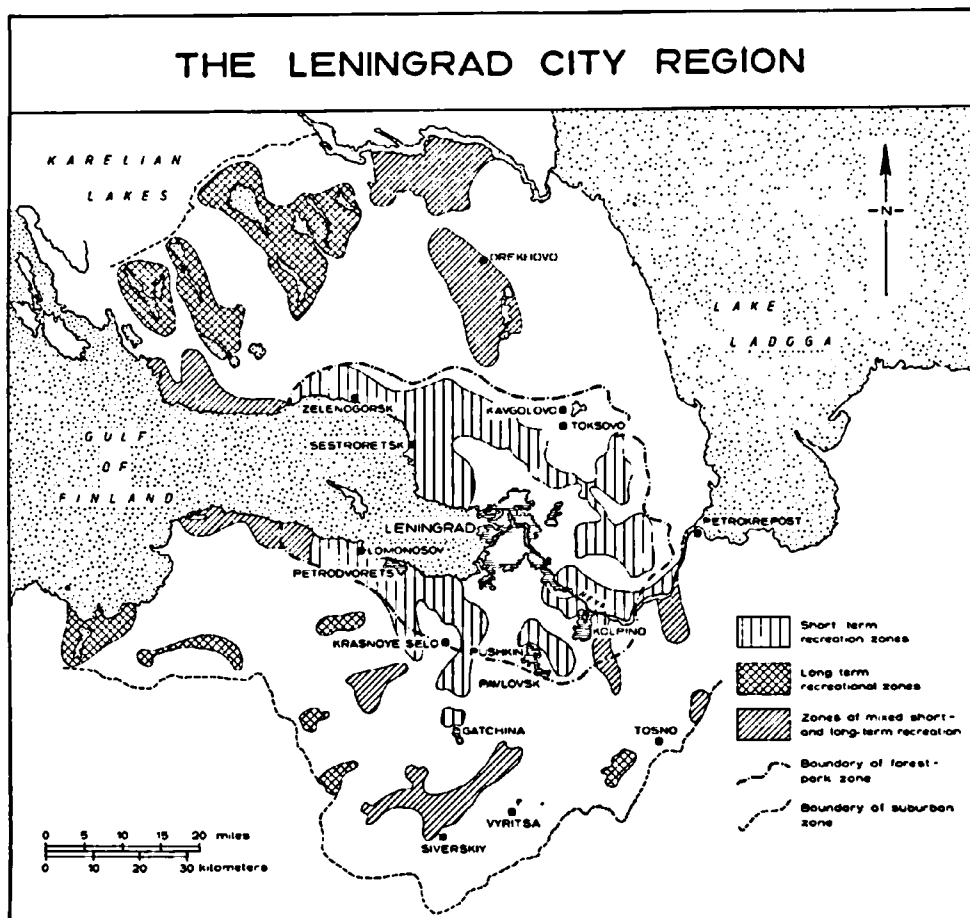


FIG. 5—Proposed developments in the environs of Leningrad according to the 1966 plan.

radius of fifty to sixty-seven kilometers of Leningrad, including the towns of Pushkin, Pavlovsk, Gatchina, Petrodvorets, Lomonosov, Sestroretsk, Zelenogorsk, Petrokrepost', and Kolpino, urbanization and population growth have been proceeding particularly rapidly. Recent estimates suggest that by the end of the century the population in this region will be approximately 6.2 million, including 5.5 million in Leningrad (well above the 3.5 to 4 million originally envisaged).⁴⁶ Hence some planners are now doubting the possibility of preserving the forest-park zone intact and are beginning to talk of "fingers of development" pushing out from the central city along the major railroad routes, especially to the south and southwest.⁴⁹

Long-term planning envisages the forest-park zone of Leningrad as increasingly devoted to industry, scientific research, and recreation. The latter is now gaining

⁴⁶ A. V. Makhrovskaya and S. P. Semenov: *Kontury bol'shogo Leningrada* (Contours of Greater Leningrad), *Stroitel'stvo i Arkhitektura Leningrada* (Construction and Architecture of Leningrad), No. 6, 1974, pp. 12-14.

⁴⁹ A second alternative is the development of a second urban node to the east of Leningrad (L. K. Panov: *Bol'shoy Leningrad—Puti yego razvitiya* [Greater Leningrad—Paths of Development], *ibid.*, No. 6, 1975, pp. 22-23).

attention among the planners, not only because the pressure of public demand is greater than ever but also because uncontrolled development can endanger conservation. Moreover, much of the recreational activity in the Leningrad region is at present associated with the phenomenon of the dacha. Dachas range in nature from luxurious villas to tiny cabins, but they are often associated with a garden plot. They are generally regarded as unsatisfactory by the planners because of their implications in a society that professes to eschew inequality and private property and because many of them are poorly planned and constructed. They at present provide approximately 93 percent of the overnight accommodation in the Leningrad region, and in the summer of 1972 they were used by more than a million people. Of these people 57 percent rented dachas from private individuals, 42 percent used dachas associated with cooperative gardens, and 1 percent rented dachas from the city government.⁶⁰ Although planners recognize the value of dachas, especially in providing fruit and vegetables to the urban populace, the general opinion now sees a need to move away from the dacha solution to the recreation problem. Far more public and commercial facilities are planned, including rest homes, tourist camps, hostels, hotels, motels, sports bases, sanatoriums, and children's camps. Concerted efforts are being made to develop nature trails and scenic routes, and facilities for camping, hunting, water sports, fishing, and other activities. Clearly, the plans are extremely ambitious. Once again, however, this facet is a reflection of how far the provision of facilities has fallen behind public demand.

CONCLUSIONS

Poltoratskiy comments on the "envy" with which urban planners view the potentials inherent in the Soviet system.⁶¹ And indeed there would appear to be much for planners to envy. The structure of the Soviet economy means that planning control can be exercised in a way that is impossible in a Western environment. To date Leningrad has escaped many of the hazards and misfortunes of the Western City. There is no decaying and declining urban center, traffic congestion is much below Western standards, there are no ghettos or massive slum districts, and the degree of urban sprawl is by no means as great as it is in the West. James H. Bater has painted a dismal picture of the prerevolutionary city, so reminiscent of Third World cities today.⁶² Viewed from this standpoint the transformation since 1914 has been remarkable.

At the same time it is clear that, although Leningrad has managed to avoid many Western problems, it is now facing other difficulties that are peculiar to the historical development of the Soviet Union. The housing crisis, the problems in servicing and cultural provision, the recreational backlog, and the growing difficulties in public transportation are the result of the long Soviet concentration on industrialization. Comprehensive planning, so obviously successful in the sphere of rapid economic growth, has yet to prove itself in the area of public consumption. The major priorities are of course chosen by the politicians, and it may be that they will feel constrained to prolong their basic industrial emphasis. This raises the questions of the extent to

⁶⁰ Yu. N. Lobanov: *Otdykh i Krov: Nekotoryye voprosy organizatsii kratkovremennogo otdykh nasele-niya Leningrada* [Recreation and Accommodation: Some Problems in the Organization of Short-Term Recreation for the Population of Leningrad], *ibid.*, No. 5, 1973, pp. 13-15.

⁶¹ Poltoratskiy, *op. cit.* [see footnote 34 above].

⁶² Bater, *op. cit.* [see footnote 4 above].

which comprehensive planning can be reconciled with democratization and of the extent to which it can be made sensitive to public opinion. Given the good will of the politicians and planners and their determination to attack the consumer problems, the question of whether there will be the capital and the necessary organization to do so remains.

On the question of organization the experience of Leningrad to date is also instructive. Quite apart from the question of financial provision, one of the basic problems in the planning of the city has been, and continues to be, the bureaucratization of the planning machinery. The problems that the contemporary city faces are huge, and an enormous planning machinery, at both the local and the national level, is needed to tackle them. Unfortunately, this makes coordination much more difficult. At the same time, as Leningrad's development is now showing, even this huge bureaucracy cannot control everything. The demographic development of the city, and the pressures for immigration of labor, are proving to be more obdurate than the planners allowed for.

The final question is that raised by Poltoraskiy—is the city a living organism or a mere built-up area? Planning can clearly solve many problems associated with spontaneous development and uncontrolled urban sprawl, but can it produce the type of urban environment with which people can truly identify? Is comprehensive planning the complete answer to the urban dilemma? Its performance in the case of Leningrad's suburbs, as in that of Great Britain's new towns, would seem to leave some room for doubt.

THE MUTATION OF THE AMERICAN CITY: A REVIEW OF THE COMPARATIVE METROPOLITAN ANALYSIS PROJECT

JEAN GOTTMANN

TO MARK the Bicentennial, the Association of American Geographers produced a monumental compendium on the contemporary American metropolis. This collective work will long be remembered and quoted. It contains abundant historical data, and it will also stand as a landmark for the 1970's, a turning point in American urban development. Future assessments will be able to build on it, and it should inspire other countries to undertake comparable projects.

The product of the Comparative Metropolitan Analysis Project, the series consists of six substantial tomes, one of them an impressive atlas. Under the direction of John S. Adams and Ronald Abler, these volumes are the fruit of the collaboration of more than a hundred geographers scattered throughout the nation. The editors were assisted by a steering committee and editorial board chaired by Brian J. L. Berry and comprising John R. Borchert, Frank E. Horton, J. Warren Nystrom, James E. Vance, Jr., and David Ward. Among those who contributed chapters are such recognized veterans of urban geography as Brian Berry, Harold M. Mayer, Howard J. Nelson, and James Vance, in addition to the editors and many younger geographers. In this massive collective work, I looked for a "manifesto" of metropolitan analysis, which in many ways has become the most popular and expanding field of study in contemporary American geography, but the manifesto was not to be found. I did, however, enjoy reading the text, most of which is lively and well written. I learned a great deal about the urban regions discussed, about the United States, and about the concerns of the profession. Moreover, I found rich food for thought.

PRESENTATION OF THE PROJECT RESULTS

This work is organized in three volumes that approach the American metropolis from three different angles. Volume 1, entitled "Contemporary Metropolitan America: Twenty Geographical Vignettes" (Ballinger Publishing Company, Cambridge, Massachusetts, 1976), consists of four collections of monographs covering twenty major metropolitan regions. In a general chapter on "The American City: Workshop for a National Culture" James Vance introduces in very subjective fashion the research project as a whole but does not attempt to summarize the "vignettes." Part One, "Cities of the Nation's Historic Metropolitan Core," discusses Boston, the New York-New Jersey metropolitan region, Philadelphia, and central Connecticut (around Hartford). Part Two, "Nineteenth Century Ports," groups Baltimore, New Orleans, and the cities by San Francisco Bay. Part Three, "Nineteenth Century Inland Centers and Ports," covers the Middle West—Pittsburgh, St. Louis, northeastern Ohio (around Cleveland), Chicago, Detroit, and the Twin Cities—and moves on to Seattle. Part Four, "Twentieth Century Cities," deals with the southern tier—Dallas-Fort Worth, Miami, Houston, Atlanta, and Los Angeles—and returns to Washington, D.C., to conclude.

Volume 2, a single book entitled "Urban Policymaking and Metropolitan Dynamics: A Comparative Geographical Analysis" (Ballinger Publishing Company, Cambridge, Massachusetts, 1976), contains twelve essays on specific metropolitan problems such as land speculation and urban morphology, abandoned housing, urban renewal, environmental goals, public and parochial schools, health care delivery, federal open space programs, housing and transportation for the elderly, and metropolitan governance and gerrymandering. In the opening chapter

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Brian Berry summarizes the volume and calls on geographers to participate in the elaboration of urban policies. Each chapter discusses the position and evolution of its specific problem on the national level and attempts comparison in several metropolitan areas chosen from among those studied in the vignettes. In only a few chapters are all twenty metropolises compared systematically.

Volume 3 is "A Comparative Atlas of America's Great Cities: Twenty Metropolitan Regions" (University of Minnesota Press, Minneapolis, 1976). It was edited by Ronald Abler, the text was written by John Adams and Ronald Abler, and the cartography was directed by Ki-Suk Lee. The atlas is the most systematically comparative volume of the series: for each of the twenty cities treated in the vignettes, Part Two of the atlas provides a general picture, mainly in the framework of Standard Metropolitan Statistical Areas (SMSAs); and in Part Three selected characteristics are mapped for all of the metropolitan regions, either on the SMSA or the Daily Urban System (DUS) level. The metropolitan region covered in each vignette does not always correspond exactly with the SMSA or DUS on the maps, but the material offered is meant to be complementary rather than to be superposed.

The atlas basically reshuffles data from the 1970 censuses of population and housing. To these statistical data the text that accompanies the maps adds some comments, occasionally of a personal and even poetical character in the introductory and concluding paragraphs of each chapter. Additional data were drawn from the *County and City Data Book 1972*. From the enormous mass of statistics supplied by the Bureau of Census, the atlas editors have extracted specific characteristics. In Part Two they have mapped the place (relief and land use), housing (housing age, value and rent, detached single units, and mobile homes), the people (density, age and the elderly, sex ratio, Negroes, Spanish-Americans, and varying features of local significance, such as Italian-Americans or Chinese-Americans, depending on the ethnic mix), socioeconomic characteristics (household size, female headship, occupations, and income), and a few topics of special local interest (ranging from labor force walking to work to crime or voting patterns). Part Three compares the twenty metropolitan regions by mapping such special topics as private systems of water supply and sewage disposal, seasonal housing units, crowded housing, rent in relation to income, working in the central business district (CBD), public transportation to work, households without automobiles or telephones, population density and change between 1960 and 1970, parochial school and enrollment, poverty population, females in the labor force, unemployed males, income from public payments, and income deficits. Some maps are repeated: for instance, the population density of Dallas-Fort Worth appears on page 186 and again on page 314, and the crowded housing in Washington, D.C. on page 262 and again on page 292. The scale of the maps often makes it difficult to observe more than general features, but some analytical and comparative effects are obtained.

The emphasis in the atlas, as well as in the other volumes, is definitely on the underprivileged, on ethnic diversity and segregation, and on the social problems of the metropolis. Ronald Abler and John Adams state this clearly in their Preface: the purpose of the atlas is to provide a partial answer to the question, What progress has been made in meeting human needs in the nation's great cities? Parts One and Four of the atlas briefly assess the general trends of American society and economy around 1970.

To read the six books page by page is not boring; but at times it is disturbing, either because of the situations described or because of the missing data, which one knows are available and which might have modified the authors' perspectives. One could produce a list of errata and of debatable or erroneous statements. Such minor defects are found in any publication, however, even one that deals with much less macroscopic phenomena. Here are the fruits of an enormous endeavor by scores of people of good will and great knowledge. It covers the past, the present, and the major problems of areas aggregating 80 million inhabitants, or 40 percent of the American nation. It encompasses the nodes of population crowding, of business and cultural activity, the total fate of which will sway the destiny of the United States and of much that depends on it in our era. I shall not waste the reader's time on picayune matters of detail. The

scope and importance of this publication call rather for discussion of its general organization and of the lessons that can be drawn from it about America, about urban studies, and about the concerns of the geographical profession.

GENERAL ORGANIZATION

A primary question to be raised concerns the selection of the twenty metropolitan regions on which the whole structure of the project rests. John Adams and Ronald Abler explain on page 7 of the atlas that the twenty metropolitan "regions" chosen are the "most populous" of the United States and correspond to DUSs, which are much wider in area than the more generally accepted SMSAs. Many of the maps deal only with SMSA data, however, as much less information is available at the DUS scale. The result is that the atlas maps of the Hartford SMSA, for instance, deal with a much smaller area than the central Connecticut region discussed in the vignette, which includes the Connecticut valley and the New Haven SMSA. Moreover, it is surprising to see the two small SMSAs of Stamford and Norwalk, Connecticut, excluded from the New York region, which encompasses large sections of New York State and northern New Jersey. By commuting and other standards Stamford and Norwalk certainly belong in the New York region. These two SMSAs are first and second in household average income among the 243 SMSAs in the nation. They also rank ahead of all others in the proportion (more than 36 percent) of managerial, professional, and technical personnel in the labor force. They have the highest ratios (26 and 19 percent, respectively) of households with incomes of more than \$25,000 a year. Their inclusion in the New York region would have modified some of its socioeconomic characteristics.

Obviously the choice and shape of the regions have been somewhat manipulated by the editors in a way that they did not elaborate. Had the twenty largest SMSAs been adopted as cores of the selected regions, Milwaukee, Cincinnati, and San Diego would have been included but Hartford, Miami, and New Orleans excluded. If the selection of the twenty metropolises was aimed at offering as good a sample as possible of the trends and diversity of cases now encountered in the United States, it would have been a pity to omit central Connecticut, Miami, and New Orleans. All three are more differentiated from the seventeen others than the larger nuclei of Milwaukee, Cincinnati, and San Diego, each of which is more closely related to at least one of the regions studied. The bypassing of Milwaukee, however, may be regretted, for it would have been stimulating to compare it with St. Louis and with Minneapolis and to appreciate the consequences of its proximity to Chicago.

All in all, the reader can be satisfied with the general selection of the twenty cases. The range obtained provides a broad tableau of both concordance and divergence of characteristics across metropolitan America. The Association of American Geographers and the editors aimed at a general tableau. They achieved their objective—but in a somewhat disconnected way. The three volumes in which the six books are organized have no common index. There is no way, short of running through at least three large books separately indexed, for a reader to find out where he can locate the material on, say, Pittsburgh; even with a detailed and lengthy search he is likely to miss the fascinating Table I of the vignette on Los Angeles, which compares the employment structure of fourteen SMSAs, including Pittsburgh. The six books put together are a gold mine on contemporary America, but the prospector who is searching for specific data may have difficulty. Better cross-indexing would have increased the value of this series as a tool for further work.

This monumental publication, called a "comparative analysis project," leaves much to be compared. The most systematically comparative part of it is the atlas. However, even here the editors emphasize general trends that are common to all or most cases studied and ultimately valid on the national scale. Perhaps more comparisons between metropolitan systems can be gleaned from Volume 2, on "Urban Policymaking and Metropolitan Dynamics." Each of its thirteen chapters discusses a specific topic both nationally and in metropolitan centers chosen

mainly from the twenty of the project. The principal comparisons deal with the needs of underprivileged urban minorities. The volume covers crime, health care, school integration, public housing, abandoned housing, and the urban elderly. The atlas thus examines similar problems, including crowded housing, rent in relation to income, public transportation to work, households without automobiles or telephones, unemployment, the poverty population, and income deficits. Some coordination (often unspecified) exists between Volume 2 and the atlas, whose maps and statistics help to illustrate many of the topics discussed in the volume. But there are many urban characteristics for which no systematic comparison is provided.

ASSESSMENT OF THE VIGNETTES

The four tomes of Volume 1, comprising the twenty vignettes, were conceived and written along more individualistic lines. "Vignette" seems a modest term for the quality of these monographs, which consist of an average of 75 dense pages of text and scholarly illustrations. The longest (115 pages) is curiously but rewardingly on New Orleans; the shortest (40 pages each) are on Dallas-Fort Worth and, surprisingly, Washington, D.C.

Each vignette is "personalized" and carries the clear imprint of the authors (most were written by a team) and of their perception of the place. Despite attempts to show that every metropolis follows the general pattern of American cities, the differentiation among cities is striking. Like other parts of the project, every vignette focuses on local problems and difficulties, but there is definitely more pessimism about northeastern centers, especially New York and Pittsburgh, than about southern and western cities. A major divide is crossed with the study of Chicago, where traditional American optimism surges again, notwithstanding regional circumstances. The spirit rises high in the Twin Cities and in Seattle. That mood is sustained for the southern tier of cities, although criticism of local situations is occasionally serious. Then the mood becomes somewhat depressed again for Washington, despite the relative prosperity of that region. Washington led all of the large SMSAs in 1970 in terms of average income, percentage of households earning more than \$25,000 a year, and proportion of quarternary personnel in the labor force.

The most disappointing is probably the vignette on the New York-Northern New Jersey region. New York is not only the biggest American metropolis but also the most complex. With a huge suburban sprawl, the metropolitan system still depends on central city activities, perhaps more than elsewhere. The vignette by George W. Carey gives less than a page to the largest financial center in the world, gives another page to book publishing, and barely mentions the mass media. After reading it one wonders why so many millions of people continue to congregate and visit there. True, the general tone of the vignettes is one of lament about each metropolis, even though the complaints may in some places be limited to rather sophisticated needs. For example, the excessive expectations of an oversized Dallas airport and the failure of the local symphony are deplored. A notable exception is the Twin cities of Minnesota, where satisfaction seems to reign.

It would be difficult to choose the best of these vignettes. Most of them are informative and provide an interesting image of a metropolis, its people, its past, its diversity; and its struggle to solve present problems. Some authors are especially skillful in offering well-organized, solid material, such as those for Chicago, Los Angeles, Seattle, northeastern Ohio, Atlanta, and Boston. On the whole, the cities of Megalopolis seem to be covered less well than some to the west, but perhaps because I know those better, I am more demanding. Or perhaps many American geographers feel a bit estranged in the Northeast because much of the tradition in American geography is rooted west of the Appalachians. Most probably, however, the present mutation of urban America is just more advanced in the older cities and has not yet reached the Northwest with much intensity. The authors of the Twin Cities vignette describe a "good life in a good place," where people enjoy remarkable ethnic and racial homogeneity: mainly American white stock with a very low percentage of blacks and Indians. "The sharp cultural and

social gradients that foster tension and conflict in many cities are absent in Minneapolis and St. Paul, producing a metropolis in which social and cultural conflict has rarely attained the proportions it has in other places" (page 359). Indeed, most of the anxieties so dominant in these six volumes are directly or indirectly related to internal ethnic conflicts, to which pollution and the decline of central cities are added in the background.

IMAGE AND INVOLVEMENT

The image that emerges from the six books of the project results from the perception that the authors have of their task and of the purposes of their profession. It is not at all the image that a similar endeavor would have produced forty or even twenty years ago. First, systematic description aims not at a tableau of different places but at an analysis of the ways in which different people live together. Second, instead of setting forth facts and trends, it has become problem oriented, with a constant worry about the decline of the quality of life in most of the areas surveyed. Third, emphasis on economic factors and development has been replaced by a focus on social tensions and welfare needs. Last but not least, the main concern of the analysis of the various metropolitan regions has shifted from the system as a whole, with an accent on the majority components of it, to the underprivileged elements, especially the ethnic minorities.

People who feel some responsibility for helping to solve the problems of the community are troubled, and geographers are among them. This change of mind reveals a profound modification in American attitudes. The old belief that the melting-pot would produce a new, improved, homogenized American strain of mankind has been shattered. As various authors in the series hint, ethnic blending is now hardly considered desirable. Atlanta accepts the coexistence of two communities within the city. Washington is described as an assemblage of cities "indifferent" to one another. When James Vance states, on page 48 of his introductory essay, that metropolitan reorganization should "avoid the disease of involuntary segregation while gaining the strength of voluntary congregation," one knows he is not just playing with words. The congregational model hints at the preference for what Canadian sociologists have called "the social mosaic," a system in which a variety of pieces are coherently joined together while remaining distinctly different from one another. This stresses the pluralistic principle in the American creed.

In 1951, I raised a question which seemed to be of more than theoretical importance to geography: if the earth's surface had been as even and uniform as a billiard ball, would it have been divided up into so many political compartments? In a recent paper, a distinguished political scientist observed that, at the time, I did not seem quite sure of the answer. Certainly, after reading the six books of this project, no doubt could be left. Even in the harmony of the Twin Cities, the vignette repeatedly alludes to the sneering at St. Paul by Minneapolis residents, for which no one could hold the Mississippi River responsible. Geographical partitioning is fundamentally rooted in the minds of men.

The model of the mosaic obtained by "voluntary congregation" may, however, be neither acceptable to all concerned nor applicable to all stages of the way of life. The basic geographical distribution studied in this project is housing, or residence, yet much more than just residence goes on in the metropolis. Some maps in the atlas and in the vignettes (for instance, on Baltimore and Washington) illustrate geographical separation of occupational groups: executives, blue-collar workers, quaternary workers, employees of the World Bank, and so forth. People of all sorts are usually counted at their homes by censuses and other surveys. But congregation also occurs at work, at school, and at play; and for these functions of daily life the human species demonstrates undeniable gregariousness. Urban centrality remains to be secured for such purposes, even if the desire for residential dispersal endures and develops.

Volume 2, on metropolitan dynamics, offers a sampling of what the geographers' contribution to the elaboration of policies may be. Indeed, no call to the profession to become committed to policy making, as uttered by Brian Berry in Chapter 1, would go unheeded.

American geographers have a long-standing tradition of helping to shape policies, as has been illustrated by the activities of Harlan H. Barrows, Isaiah Bowman, John E. Orchard, Edward A. Ackerman, Gilbert F. White, and others. The various chapters of Volume 2 do not necessarily suggest participation as active as that of these men, but on specific problems arising from the needs and ills of the metropolis they demonstrate the usefulness of geographical data and methods.

It is interesting to see, for instance, how geographical analysis of data on crime enables Gerald F. Pyle to draw conclusions about the changing crime rates in the nation. Such techniques assume that equally reliable and standardized statistics can be provided for other characteristics of a wide range of places. On health care delivery, Mary Megee sets forth somewhat more subjective but strongly documented views, which could well animate a debate with public health specialists. On gerrymandering in the ghetto, John O'Loughlin supplies rich and original material and calls for redistricting on a nonpartisan basis. There is ample food for thought and action in this volume, in which most chapters suggest reform and call for more justice.

Although the six tomes of this project prove once more that geography is relevant, they seldom demonstrate what questions geographers can raise and what correlations they can establish that are not contributed by other professions—questions and correlations that would improve the understanding of American cities and better the human condition in them. Perhaps the greatest contribution in this direction is made by the sum total of the twenty vignettes. Separately each of them is just a monograph of mostly “old-style” strain, with an emphasis on social geography. Taken together, however, they provide a nationwide picture of change and resistance to it and of a fascinating blend of common trends and concerns with a striking diversity of places, local structures, and attitudes. A general image emerges somehow from the reading of the vignettes, but nowhere is it brought forward as it ought to be. Such a task is beyond the scope of a review article. Only a few remarks about the changing metropolis can be attempted here.

GEOGRAPHY AND THE CHANGING CITY

Discussing recent books on the early Fabians at the turn of the century, C. P. Snow observed, “They did want efficiency but this didn’t preoccupy them as their social reforms did. Somehow there would always be enough wealth to go around, and somehow it would presumably be created.” This viewpoint could almost apply to the project’s attitude toward the metropolis. Geographers are not economists, but they used to be and still are seriously concerned with the economic substratum of populations, places, and ways of life. As is obvious in this project, the present vogue of relevance to social reform puts economics and the production of wealth into the shade. Yet the nation or the local community still must have the means to help the needy and improve the urban condition. A strong case could be made for the hypothesis that central cities such as New York and Washington would not have experienced their present plight had they been less generous in extending welfare to newcomers and in using public funds to improve the standards of the underprivileged who flocked there.

Such considerations are not found in the six scholarly tomes. Curiously, James Vance, on page 48 of his conclusion to Part One of Volume 1, suggests that planning ought to aim at saving nonrenewable resources and “that to-day the resource we have in greatest abundance is labor and it is our one naturally renewing component.” One wonders how much labor, in present circumstances, could be used to save energy. Could Americans revert to walking and set aside the automobile which has practically become part of their wardrobe? Even if such a changeover could occur, it would require a complete restructuring of the metropolis and might not reduce unemployment.

Serious economic analysis is essential to geography and to urban studies. Many of the vignette authors are well aware of it. They do not forget about employment or the need for urban centrality in the modern metropolis, though the nature of that centrality may be very

different from Walter Christaller's. Several monographs worry about a rising skyline or the lack of it. In fact, the social concerns focus mainly on the inner cities and on the uncomfortable situations arising there from the proximity of central business and monumental districts to a spreading welfare camp of newcomers who are seeking refuge from less generously endowed rural areas and smaller towns.

The destiny of the central city in economic terms remains a key factor for the future because it joins together the various systems of the nation. The medium-sized metropolis is still building up its skyline and other components of the center. Even in some of the larger central cities, such as Chicago, Los Angeles, or San Francisco, the business districts are expanding in physical terms, though the vicinity may be losing residents and even jobs. The very nature of urban centrality in large units is undergoing fundamental change, a phenomenon repeatedly hinted at in the vignettes. Further study of these changes is required if urban geography wants to contribute more actively not only to the description and questioning but also to the diagnosis of the evolution. Indeed, geographers today want to shift the purposes of their discipline from a descriptive anatomy of the metropolitan systems to a more prophylactic attitude. Hence the drive toward planning, applied geography, relevance, and policy-making participation, and hence also the necessity for taking a broad, longer-range view of the processes that are restructuring urban society.

The new types of buildings and land uses provide significant leads: manufacturers, warehouses, and establishments trading in goods are replaced in "central districts," old or new, by offices, hotels, hospitals, convention halls, universities, research institutes, museums, sport stadia, and recreational establishments. Instead of manipulating goods, the central district administers or entertains abstract transactions and collective rituals. This trend expresses a basic change, gradual but irreversible (short of a complete breakdown of modern civilization) in the ways people work and spend their time. This change replaces various forms of hard physical labor with other kinds of work, mainly processing information. Perhaps the best way to understand the long-range trends of urbanization would be to examine the evolution of the conditions of employment. Gradually employment provides better pay, more free time, less attachment to a single place, broader interests, more incentives to learn, and greater need for information of many sorts. The constraints that for ages locked people into places are gradually being removed. With increasing division of labor and specialization, however, each specialty comes to depend more on a greater number of other specialities in order to do its own work adequately. New forms of aggregation ensue.

These trends are not all so new. They started many millennia ago, perhaps with exploration beyond the horizon, early mathematics, or the myth of Prometheus. They accelerated with the Renaissance, the Industrial Revolution, the abolition of slavery and serfdom, and the white-collar revolution of recent years. Technological progress is not an adequate explanation for this social metamorphosis. The same technology is usually available to several nations that use it differently. Labor and tax legislation vary geographically much more than does the knowledge of specialists. A society controls its way of life largely through the conditions of employment, the rewards assigned to the various occupations, and the constraints imposed on movement.

There is still a great future in the geography of the modes and conditions of employment. It may be related to a geography of recreation and to a geography of information markets. Those who engage in such studies may find illuminating directions in metropolitan analysis, but by looking at more than housing and industrial location. Urban centrality increasingly depends on government offices, even though some dispersal of federal bureaus has developed around Washington; it also depends greatly on centers of higher learning and related institutions. Campuses are growth poles within cities. What used to be called the CBD is turning into an "institutional district." The services performed by these institutions cannot be termed "parasitic" just because they do not produce material goods. To be liberated from hard physical work is the most ancient and permanent yearning of mankind. We are gradually coming close to this liberation. This immense revolution requires a restructuring of employment and a metamorphosis of the built environment to fit novel modes of life. The large metropolis is the

essential incubator of that new society. It entails trauma, as every metamorphosis does. It also transforms landscapes, though changes in hardware generally lag behind the evolution of the software.

A clear example, and very geographical, may be found in the old seaports. The vignettes supply good illustrations for this example. Fifteen of the twenty metropolises are ports on the sea or the Great Lakes. Only Pittsburgh, St. Louis, the Twin Cities, (three old river ports), Atlanta, and Dallas are inland. But the waterfront is changing. The old function of handling freight and passengers next to the CBD is largely gone. Shipments are handled chiefly in specialized harbor installations at peripheral locations; passengers and precious freight go through airports.

But the location of transactions sticks to the vicinity of old wharves. New business centers may arise in various places, but old ones are not easily transplanted. Transactions and news gathering depended in days of yore on the movement of ships. These may be gone, as one discovers when one surveys New York's Upper Bay, Boston Harbor, or San Francisco's piers from neighboring skyscrapers, but transactional activities continue in the vicinity and often expand. The vignette on Seattle tells of the recent renewal of a waterfront. Similar developments can be found, on even larger scales, in San Francisco, Boston, Detroit, Chicago, New Orleans, and even New York. The new town-in-town around Quincy Market in Boston, recycling old monumental warehouses, is a spectacular case in point. Comparable mutation of waterfront districts can be observed in other cities from Marseille to Vancouver. This testifies to the vitality of urban centers, despite or owing to rapid change. But the kinds of work and the conditions of employment observable in these ports nowadays show the depth of the metamorphosis.

The seaports, even when they lose the sea trade, have held fast in terms of centrality, and this fact requires careful examination. A basic generalization of this geographical stability is the staying power of an established node of transactions, with its personnel, with its invisible but essential network of relationships beyond the region and beyond the seas. In the complex machinery of modern economic systems, the interrelationships woven around the world need many active hubs of the sort that lively ports were in the past. New York is still the greatest information and mass media market in America, a function inherited from its sea-trading past; and it helps the city to survive.

The new ways of work, of employment, of transactions, have made large numbers of quaternary and even secondary personnel extremely mobile. The hubs of large cities receive constant flows of transients, most of whom come for some kind of business, that animate the cities but modify their character. The community in such cities integrates the activities of many who are neither residents nor officially employed there but who come recurrently or irregularly, sometimes from afar, and become part of the local system. Other newcomers arrive and settle there for good—from parts where they do not find similar opportunity. The urban community acquires nowadays a diversity and a pluralism hardly admissible in the past.

The real dilemmas are in the central parts of the system. The problem of the suburban sprawl is only one among many in the American metropolis. Geographers are still riveted to the place, to the region, even when they discuss metropolitan agglomeration and when they care about people. The life of these vast organisms should not be examined simply on the local or regional scale, each unit being considered separately or "comparatively." The metropolis is a joint, a node, in vast networks, at the least national and often cosmopolitan. The old urban community, concerned only with the surrounding area, homogeneous, hierarchical, independent, keeping strangers outside its walls, is no more. Perhaps one can still find such cities in the most backward areas of the modern world. But the momentous mutation of this century, largely America's doing, creates new structures and calls for new solutions. This is a fundamentally geographical phenomenon, because it is inscribed in the organization of space and of society and in the relationships between people and place. In contributing to the understanding of this mutation geographers could help to soften the pains of the metamorphosis for all and advance the cause of the underprivileged as well.

APPLIED GEOGRAPHY

THE EXPERT WITNESS: A GEOGRAPHER'S PERSPECTIVE ON ENVIRONMENTAL LITIGATION*

JAMES K. MITCHELL

MANY geographers who are interested in formulating and enforcing environmental policy are offered an opportunity to testify in court. This experience is significantly different from most other aspects of geographical work, yet little has been written to inform prospective witnesses about the nature of the task that lies ahead.¹ In this paper I shall identify various phases of the involvement of experts in one type of litigation, outline some of the strategies, tactics, and personalities encountered in courtrooms, and supply tentative guidelines for pretrial preparation, for testimony, and for response to cross-examination.²

Reasons for testifying in court range from a desire to be involved in an important environmental decision-making process, through a need to take a public stand on an issue of personal or professional importance, to an appreciation of the financial rewards of consultation. However, credibility tends to decline in direct proportion to the size of a consultant's fee, to the frequency of testimony, and to the number of successive clients served.

Whatever the motivation, expert witnesses are now common participants in environmental court suits. This is due, in large part, to the innately complex and technical nature of the issues. Specialists in the physical and natural sciences are often employed as witnesses, but social scientists are increasingly visible as experts on, for example, economic impact modeling, demographic projections, or flood plain management alternatives.

Most frequently, National Environmental Policy Act (NEPA) litigation provides the setting for expert involvement at the federal level. Between 1970 and 1975 approximately three hundred such cases, based on environmental impact statement (EIS) challenges, were heard before United States judges.³ Alleged violations of federal Air and Water Quality Acts and the Endangered Species Act provide additional outlets for experts. Although court testimony is of chief interest here it is not the only, nor the most frequent, type of expert activity. Experts often do not appear in a formal trial. Instead, they may supply information, under oaths administered by legal officers, in the form of written depositions, subpoenas, or interrogatories. These

* This paper has benefited from critical review by Dr. William Goldfarb, of the Department of Environmental Resources, Rutgers University.

¹ W. Anthony Wiles: The Expert Witness in Land Use Litigation, *Environmental Comment*, August, 1976, pp. 16-20; and William A. Thomas, edit.: Scientists in the Legal System: Tolerated Meddlers or Essential Contributors? (Ann Arbor Science Publishers, Inc., Ann Arbor, Mich., 1974); Kenneth E. Boulding: The Impact of The Social Sciences (Rutgers Univ. Press, New Brunswick, N.J., 1966), chapt. 4. For recent documentation of legal perspectives on the role of expert witnesses and a discussion of ethical and disciplinary considerations, see Lawrence Rosen: The Anthropologist As Expert Witness, *Amer. Anthropologist*, Vol. 79, 1977, pp. 535-578.

² This is not an exhaustive treatment of the range of legal proceedings with which geographers may be associated, nor is it necessarily representative of the experience of other witnesses. My observations grow out of personal involvement as a federal court witness for a public interest law group between July, 1976, and January, 1977. During this period, public and private plaintiffs in New York and New Jersey sought to restrain the sale of offshore oil and gas exploration leases and to delay subsequent exploratory drilling in the waters off the Middle Atlantic states pending issuance of an EIS by the Bureau of Land Management. See *New York v. Kleppe*, U.S. District Court, Eastern District of New York, *Environmental Reporter*, March 18, 1977, 9ERC 1798-1823.

³ "Environmental Quality, The Seventh Annual Report of the CEQ" (Council on Environmental Quality, Washington, D.C., 1976).

may form the basis for summary judgments or may be introduced as evidence in later trials. In addition, experts may testify orally or submit written commentaries on proposed legislation, regulations, or related matters before hearings by legislative committees, public agencies, and other fact-finding groups.

Complex reasons govern the selection of an expert witness, but the chief criterion is probably the degree to which he or she can further a preferred legal strategy. Nonetheless, the expert can help to shape that strategy through critical review of documentary evidence and early consultation with the legal staff. Opportunities for such participation vary. Plaintiffs and public interest law groups are more likely to encourage witnesses to play formative roles than are defendants, private law firms, and government agencies. These contrasts reflect differences in the need to substantiate established positions, variations in the availability of preparation time, and the relative pressure of other business among the parties at issue.

The role of the witness in a typical court action can be subdivided into six basic stages. Expert help is initially sought during the drafting of pleadings. This may involve the expert in specifying types of damage to a plaintiff's interests that may occur if a proposed environmental action is taken. Further involvement ensues during the "discovery" period, when legal arguments are refined in the light of the expert's detailed analysis of major issues. Thirdly, the witness may aid in formulating a motion for summary judgment. This asks for a judicial ruling without a formal trial. If a trial is called for, pretrial preparation constitutes a fourth phase. A period of days, weeks, or months is generally taken up by such preparation. For a plaintiff's witnesses this is followed by several hours or days of court testimony and cross-examination. During that period a defense witness may aid in the selection of questions to be asked of the plaintiff's experts. Subsequently, these roles are reversed and a plaintiff's witness may informally aid legal counsel in the questioning of defense counterparts. Finally, witnesses may be asked to review the progress or outcome of the case with the legal staff and to help plan further action. Although my comments illustrate the role of plaintiff witnesses in NEPA cases, the perspectives of other experts are not significantly dissimilar. For purposes of simplification, I shall treat the first four stages of expert involvement together as phases of preparation.

PREPARATION

Although expert witnesses are familiar with much of the theory and practice of the subject about which they propose to testify, they are not expected to possess an intimate knowledge of facts pertaining to the contemplated court suit. In NEPA cases the process of acquiring this knowledge is usually initiated by a detailed analysis of all pertinent environmental impact statements. This may include relevant sections of draft and final statements for a specific proposed action and the program of which it is a part, together with all maps, supplementary studies or technical papers, and appropriate appendixes. Studies of the proposed action by other groups are also valuable sources. For example, important studies of offshore oil and gas developments in the Middle Atlantic states have been published by consultants to the American Petroleum Institute, the Office of Technology Assessment, and the Council on Environmental Quality.⁴ These provide cross-checks on factual information, use contrasting assumptions and analytical methodologies, and supply yardsticks for assessing the reliability of predictions or projections contained in an impact statement. A witness's testimony is strengthened to the extent that it reveals that authoritative information was available before the publication of an impact statement but was ignored in its compilation.

Witnesses should also be aware of evolving public policy as evidenced in the published record of recent legislative committee hearings, relevant policy studies conducted by legislative

⁴"Mid-Atlantic Regional Study: An Assessment of the Onshore Effects of Offshore Oil and Gas Development" (Woodward-Clyde Consultants, Clifton, N.J., 1975); "Coastal Effects of Offshore Energy Systems: An Assessment of Oil and Gas Systems, Deepwater Ports and Nuclear Powerplants Off the Coast of New Jersey and Delaware" (Office of Technology Assessment, Washington, D.C., 1976); and "OCS Oil and Gas: An Environmental Assessment" (5 vols.; Council on Environmental Quality, Washington, D.C., 1974).

and administrative advisory groups, and proposed or enacted regulations published in the Federal Register or similar state publications.⁶ If the literature on a particular type of development is sparse it is often necessary to search for analogous situations. Thus, where offshore oil and gas development is at issue, information from key studies of deepwater ports, of floating nuclear power stations, and of other technological innovations dealing with the continental shelf can be crucial. Useful data about the likely socioeconomic impacts of oil spills on recreational beaches can be gained from reports of beach closings owing to excessive pollution by sewage or similar hazardous substances.

The thoroughness of preparation depends on the time and assistance available. Some legal organizations can provide staff support to aid in this task. At other times experts must rely on their own investigations. In either case the experts should, if possible, visit the sites of proposed activities to become familiar with local conditions that may have a specific bearing on the legal arguments. This increases a witness's credibility with the court and reduces the likelihood of neglecting vital field evidence. For example, recent changes in coastal morphology can drastically modify the impacts of oil and gas pipeline routes that are plotted on maps prepared years ago.

For plaintiff witnesses in NEPA cases the immediate objective of acquiring detailed background information is the preparation of impact statement critiques and the listing of factual errors and inadequacies. Such lists are refined in the light of supporting evidence and preferred legal strategies advanced by the witness's attorneys and those of allied plaintiffs. Following the maxim that cross-examination will rarely involve what the expert knows thoroughly, marginal impact statement flaws or criticisms that rest solely on the witness's personal judgment are usually discarded and the list of items to be included in testimony is shaped into a logical, ordered, and mutually supporting argument.

A number of points should be kept in mind while developing one's testimony. Facts are of primary importance in the courtroom, especially when supported by evidence from several authoritative sources. Professional opinions, based on theoretical or practical experience, may be acceptable but are less valuable. Certainty, precision, clarity, and conciseness are highly prized attributes, though not all issues lend themselves to discussions of that type. The ability to supply more refined and reliable data, or to provide valuable analytical procedures overlooked or neglected by the defense, is particularly telling in NEPA cases if such additions can be shown to produce significant new policy outcomes. Well-organized testimony makes judicious but sparing use of visual aids. Laws that are relevant to proposed testimony should be carefully read. Intellectually supportable arguments carry limited weight unless they can be linked, directly or indirectly, to particular statutes. Finally, although giving expert testimony is not the same as lobbying for a particular policy alternative, it is permissible for the expert's own convictions to show through occasionally. As evidenced by the existence of opposing experts, a witness's professional expertise is never absolute in court. Therefore, simple, reasoned testimony lightly infused with admissions of personal preference is more persuasive than a nominally "objective," technically sophisticated presentation.

Often a prospective witness will have begun to research an issue before a formal decision to institute court action is taken by the plaintiff's attorneys. Attempts may be made to arrive at an out-of-court settlement. Once the decision to file notice of suit is accepted, new lawyers—who will actually litigate the action in court—may be added to the expert's team.

At this point approximate dates for the court appearance are scheduled. Precise timing is not generally possible because the testimony of previous witnesses may take longer or shorter than expected. There is also much debate about optimal timing, but most plaintiff attorneys prefer early appearances by "their" experts, while judges are still in the process of formulating initial opinions. In NEPA suits against federal agencies, state government plaintiffs often claim precedence over others by virtue of their role as guardians of the public interest in an impacted

⁶ See, for example, "Effects of Offshore Oil and Natural Gas Development on the Coastal Zone" (a study prepared by the Congressional Research Service, Library of Congress, for the Ad Hoc Select Committee on the Outer Continental Shelf, U.S. House of Representatives, March, 1976).

area. Thus their witnesses may appear first. Such legal traditions are more likely to govern the sequence in which experts appear than are cooperative decisions about the optimal presentation of evidence to achieve continuity and maximum effect.

Just before they appear in court, witnesses are briefed about direct testimony. This is an essential component of preparation, particularly for a "virgin" witness. Observance of legal ethics is required. Attorneys are not permitted to tell witnesses what to say. They may, however, lay out the framework and content of questions to be asked during direct testimony; they may demonstrate the range of ways by which cross-examination questions are formulated, and they may clarify experts' queries about such topics as legal procedures, the rights of witnesses, and appropriate dress or demeanor in court.

COURT TESTIMONY

Once called to testify, the expert is sworn in by a court clerk and seated. Now begins a complex process that involves verbal exchanges among the witness, one or more attorneys for the plaintiff and for the defendant, the judge, and the official court recorder. First the witness's expert qualifications must be accepted by the court. This is normally done after educational attainments and publications are listed, together with pertinent research, teaching, and public service experience. The judge may dispense with most of these formalities and ask that curriculum vitae or other written material be entered in the record. If one is fortunate the judge may also be sufficiently conversant with academic disciplines to understand the intellectual background of geographers and the limits of their competence. More often, the witness will be called on to explain the relevance of geographical training to the proposed testimony.

The second stage consists of direct testimony from the expert in response to questions asked by his or her attorney. This is a relatively straightforward activity whose essentials are already known to the witness through the pretrial briefing. The expert may find it useful to consult written notes or other documentation when replying to direct questions. Because these materials can be subpoenaed and disseminated by the court, they should be kept brief and non-committal. It is prudent to omit clues about the plaintiff's general strategy or other potentially exploitable information.

Subsequently, other plaintiff attorneys may take up the direct questioning with the objective of drawing out confirmatory evidence to support previous or forthcoming testimony by other witnesses. The extent to which the expert is forewarned of these latter questions depends on the degree of pretrial cooperation among the various plaintiffs. However, legal strategies are dynamic and continue to evolve throughout a trial, thus raising the possibility of unexpected questions from "friendly" lawyers. For example, objections by attorneys representing the defense may cause questions to be withdrawn or rephrased and can necessitate other rapid tactical changes that affect the course of direct testimony.

The third stage of testimony involves cross-examination by defense lawyers. This is likely to be the most traumatic, but also the most rewarding, part of the court experience. One or more attorneys in turn attack the witness's credibility or otherwise cast doubt on direct testimony. Cross-examination may continue for hours or days, depending on the salience of that testimony. Several types of strategy and a variety of questioning styles are common.

One cross-examining attorney may attempt to demonstrate that the expert's arguments and assumptions are erroneous or misplaced. For example, by seeking the expert's agreement that federal authorities have no power to dictate state and local land use programs he tries to undermine testimony asserting that hastily conceived and implemented federal development plans for the outer continental shelf can negatively influence those programs. Likewise, he attempts to sidestep criticism of EIS shortcomings by portraying the witness as a specialized scientist who is applying unrealistically precise evaluative criteria to a nonscientific document. The tone of the questioner is abrasive, emotional, or threatening. Accusatory fingers are thrust in the witness's face. His reputation and qualifications are ridiculed and his opinions scorned.

A second attorney may adopt a conciliatory stance. He is calm, courtly, reflective, and "reasonable." "Much of what you have said is worthy of discussion," he says, "but cannot intelligent people disagree about potential impacts which are fraught with uncertainty? Let us explore some of these debatable areas." Thus begins a careful exercise designed to blunt clear-cut testimony and to shade its meaning in various neutral tones. The strategy is subtle and potentially devastating because it develops a consensual, "academic" atmosphere in what is essentially an adversary setting. Unless the witness exercises mental discipline, this in turn increases the scope for other interpretations of the evidence on which the direct testimony is based and leads to eventual reaffirmation of the alternative that most closely sustains the defense's original arguments.

A third defense attorney may introduce another change of pace. He is formal and business-like. Questions are restricted to simple matters of fact. "Which operators of pipecoating firms have you interviewed?" "Do you know the names of natural gas pipeline companies serving this state?" "What is the population and total area of New Jersey?" No expert opinions, judgments, or conclusions are called for, and few opportunities are given for qualifying an answer. The primary objective is to illuminate gaps in the expert's knowledge rather than to break or weaken the direct testimony. In final arguments an alternative interpretative framework which refutes that testimony can then be constructed around these gaps. Many other methods of cross-examination can be used, but these are sufficient to illustrate the types of questioning that may arise.

Although no two cross-examinations are alike, some general observations on witness responses may be helpful. First, it is usually futile to engage the cross-examining attorney in a battle of wits. Few expert witnesses are sufficiently well acquainted with legal knowledge, court procedure, and litigious strategies to win such an encounter. Nonetheless, this should not be interpreted as implying that experts are not capable of a spirited defense of their testimony. For example, the adversary nature of the proceedings tends to direct answers to complex questions into simple yes or no responses. These are frequently misleading oversimplifications that result in identifying the witness with extreme or insupportable positions on particular issues. Experts may wish to arrest this development by illuminating the fallacious assumptions on which the cross-examination questions are based.

The ability to "think on one's feet" and to make constructive use of time are key skills in responding to cross-examination. Calm and considered replies are the best insurance for sustaining one's direct testimony. This permits recognition of hypothetical or otherwise "loaded" questions which can distort the basis of that testimony. Objections raised by "friendly" attorneys provide time to formulate appropriate responses to rapid sequences of complex questions. Similarly, experts should take care to complete their answers even when interrupted by the cross-examiner's next question. Requests to read extracts aloud from court transcripts or published documents should trigger a mental search to establish the contextual significance of the quotation, for passages are frequently taken out of context. Before responding to questions it is well to read such material carefully to identify countervailing points in the same or succeeding paragraphs. Other guidelines include not volunteering unsolicited information under cross-examination. Such material often increases one's potential vulnerability. Conversely, it is vital to admit errors of fact or judgment contained in personal testimony, and lack of knowledge or expertise where they exist. Witnesses who guess invite trouble. Furthermore, the most important testimony will have little effect if it is not heard by a presiding judge. The latter's attention is often diverted by messages from court officers, and the witness should pause until these interruptions have ended.

When the cross-examination is completed, the expert's attorney resumes questioning to reconstruct any direct testimony that may have been weakened by the previous intense questioning. This phase is usually brief and concludes the witness's formal court appearance.

Few trials flow smoothly. Judges may interrupt testimony to seek explanations or clarifications from experts. Court recorders may also ask for correct spellings or repetitions of

inaudible testimony. Microphones may break down, and other unexpected events may occur. Recesses may be called for brief bail application hearings for suspects in other cases being heard by the presiding judge or while criminal juries are charged before being sequestered to consider their verdicts. The witness may request a recess to regain energy needed for continuing cross-examination. Each break disturbs the momentum of the trial and may occasion subtle shifts in questioning or provide breathing space for a hard-pressed witness.

POSTTRIAL ACTIVITIES

The extent to which an expert is involved in posttrial actions depends on the outcome of the trial. If a judge's ruling is appealed to a higher court further consultation with the legal staff may take place, but subsequent personal court appearances are not likely. If no appeal is made the expert's involvement is likely to end. However, the parties at issue may agree to forgo court action in favor of an out-of-court settlement. Experts are likely to be consulted in drawing up such settlements.

GEOGRAPHERS AS EXPERT WITNESSES

For geographers who are interested in broadening their professional involvement in environmental management the experience of serving as an expert witness is invaluable. It gives scholars a chance to improve the quality of public policy in a direct manner. It provides exposure to a problem-solving forum far different from that of the seminar room, the planning studio, or the administrative agency. It introduces academics to other scholars, lawyers, public officials, and private citizens with common interests and establishes links that can enhance teaching and research for faculty and students alike.

Geographers, as expert witnesses, have much to offer to courts, particularly in the field of comparing and contrasting specific environments. Few other experts venture beyond narrow specialties. Geographers are highly sensitive to differences and similarities in physical systems, to processes of areal organization, and to human interaction. This sensitivity permits them to assess the uniqueness or generality of limited information about human modification of the environment. Their ability to interrelate information drawn from varying areal scales and their broad concern for long-term landscape evolution, for the role of unexpected events, and for planned change confer a suite of related perspectives that is usually missing from other analyses of contemporary environmental changes.

Clearly, courts are not the only means of resolving environmental issues. For example, greater stress is now placed on public participation in decision making and consensus planning as alternatives to long, costly, and debilitating legal battles. Indeed, in a society where legal institutions are already overburdened by petitions to resolve varied public policy disputes, where personal competition is endemic, where adversary procedures for settling disputes are characteristic, where interest group conflict is a normal feature of policy formulation, and where confrontation is a common recourse there is every reason to encourage the use of other methods for achieving sound environmental management. Nevertheless, courts may provide the only available avenue for environmental decision making when other remedies have failed. In such situations geographers should be willing and able to use this outlet for their disciplinary talents to advantage.

GEOGRAPHY, ENVIRONMENTAL ANALYSIS, AND ROUTE SELECTION OF EXTRA HIGH VOLTAGE TRANSMISSION LINES

BRUCE J. BUVINGER

SINCE the National Environmental Policy Act (NEPA) was passed in 1969 Americans have become increasingly aware of the need for environmental legislation that will protect the nation's resources and at the same time allow for growth in the economy, particularly in the development of potential energy resources. As our knowledge of the environment increases, we become better able to describe the environmental impact of proposed projects and to take the steps necessary to avoid or mitigate any adverse impact.

In order to clarify the intent of NEPA and give federal agencies some direction for implementing the act, the Council on Environmental Quality issued a set of generalized guidelines¹ for the preparation of environmental impact statements. In turn, many federal agencies such as the Federal Power Commission² and state and local governments have issued more specific guidelines that describe the important points that agencies consider in preparing environmental statements on proposed projects. If a governmental agency determines that an environmental statement must be prepared for a specific project, then the firm (applicant) proposing the project must prepare an environmental report, which includes a complete description of the proposed project, a description of the existing environment, and an assessment of the probable environmental impacts expected as a result of the project. The applicant submits the completed environmental report as an exhibit in support of a request for a construction permit to the lead agency, which then prepares a draft environmental statement. The draft is widely circulated to solicit comments from any interested agency, organization, or individual. After all comments are received and addressed, the lead agency prepares a final environmental statement. Public hearings are then held, and a board of examiners makes a decision to allow or disallow the proposed project. In this paper I deal with the preparation of environmental reports, which are usually patterned after the guidelines that the lead agency uses in preparing the draft and final environmental statements.

The routing of extra high voltage (EHV)³ transmission lines is only one type of energy project that, in most cases, now requires the writing of an environmental report; and although I deal only with the environmental analysis of transmission lines, the approach described here is that used for such varied types of energy-related projects as fossil and nuclear power plants, coal gasification plants, substitute natural gas plants, strip-mining operations, and pipelines, as well as other projects that may have a major effect on the environment.

Geographers can function in key roles in conducting environmental analyses. Because they possess a varied background combining training in physical subjects with training in cultural fields, they have the general understanding necessary to synthesize the findings of such specialists as geologists, hydrologists, archaeologists, pedologists, biologists, meteorologists, demographers, and engineers.

This paper, therefore, serves two purposes. It describes the procedures usually implemented in preparing an environmental analysis for an EHV transmission line, and it comments on the

¹ "Environmental Quality: The Fifth Annual Report of the Council on Environmental Quality" (Council on Environmental Quality, Washington, D.C., 1974), pp. 506-540.

² "Code of Federal Regulations: Title 18, Conservation of Power and Water Resources" Chapter 1, Federal Power Commission, Part 2.80 (Office of the Federal Register, Natl. Archives and Records Service, General Services Admin., Washington, D.C., 1974), pp. 70-81.

³ Extra high voltage is usually recognized as ranging between 300 and 1000 kilovolts.

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appropriateness of geographers' educational training for professional work in the environmental field.

ENVIRONMENTAL ANALYSIS PROCEDURES

Although flexibility is desirable and indeed necessary in preparing an environmental analysis for an EHV transmission line, the procedure normally involves selecting and describing an appropriate study area, contacting governmental agencies, acquiring and analyzing data from either primary or secondary sources, establishing tentative routes, comparing alternatives, and selecting the best route. Depending on the scope of the project, some tasks may take longer to complete than others, some may be eliminated entirely, or some performed earlier in one project than in another.

The first step in the process is to select an appropriate study area. An outline of the environmental report is prepared at this time. The size and shape of the area may be altered during the study, and the outline may be revised as often as necessary to reflect changes in the project.

The next major step is to initiate contacts with federal, state, and local agencies. Early involvement of governmental agencies at all levels helps in identifying potential problems and aids in developing satisfactory solutions. Cooperation between all concerned parties is essential in working out differences that may arise in such a project.

Concurrently, data acquisition is begun. Data may be from published books, reports, printouts, maps, and similar sources. Maps are an extremely important tool in these projects, not only in identifying locations but also as a source of data and as a method of presenting information. Most geographers have had some training in cartography and are able to read and interpret maps accurately. During this phase, fieldwork is an important and necessary component. The term as used here covers not only site-specific fieldwork but also many other forms of gathering data, including visits to agencies and personal interviews. Also during this phase the study area is observed from the air and inspected from the ground. Photographs are taken of selected features for later reference. Where secondary data are lacking, local consultants are often employed to conduct specific studies and submit their findings to the staff preparing the environmental report.

Data analysis is the next major step. All data gathered are organized in a project resource file. Information gathered during preliminary fieldwork is seldom complete, and missing data must be identified and secured, either by telephone or by additional fieldwork. Consultants' reports are reviewed for completeness. Agency coordination meetings continue for the duration of the project, and fieldwork can often be planned to coincide with meetings in the project area.

After initial data have been gathered and analyzed, the entire study area is described in terms of various physical and cultural geographical factors. Based on this general information, tentative routes are established. Each route is then examined in detail, and the potential impacts are identified and described. The next step is selecting the best route and ranking the alternatives. Report sections are constantly revised as necessitated by changes in the project or as better data become available. A preliminary draft is prepared. After receiving comments from the applicant, consultants, and agencies, a final draft of the environmental report is prepared and delivered to the applicant.

SELECTION OF A STUDY AREA

In some cases a proposed transmission line route has already been determined by a previous environmental or engineering study, by a particular pattern of landownership, or by a desire to use or to parallel an existing right-of-way. In those instances the actual width of the right-of-way may be examined, or, more commonly, a corridor on one or both sides of the center line may be chosen for environmental considerations. When a tentative route has not already been chosen, a study area is selected. Beginning and end points of the proposed transmission line

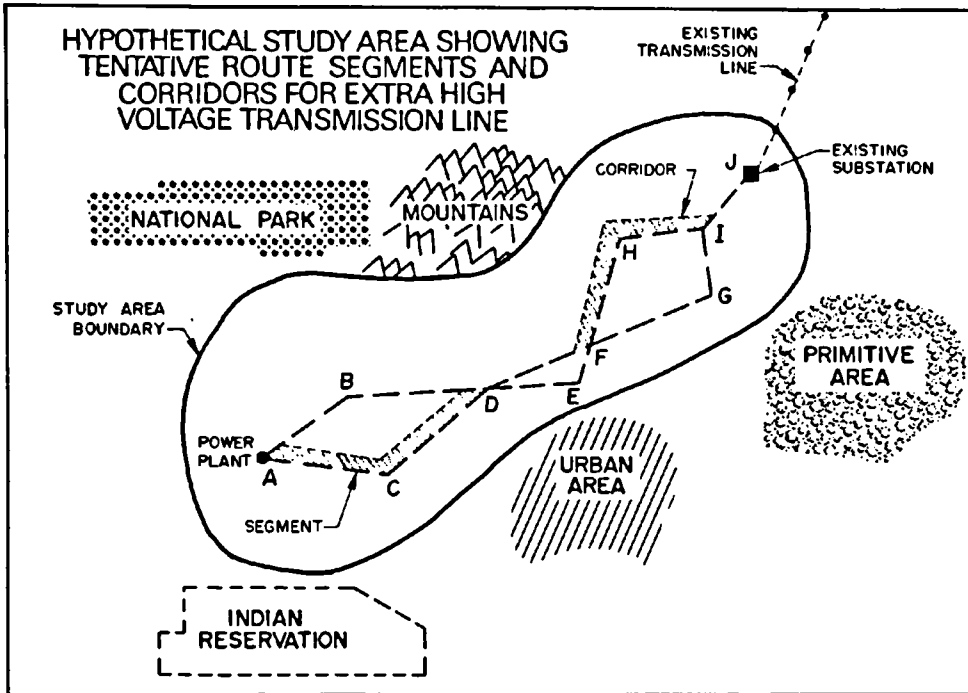


FIG. 1.—Hypothetical study area for a proposed extra high voltage transmission line. The study area boundary is based on the beginning point (power plant) and end point (existing substation) of the proposed transmission line and on the obvious features that would hinder routing. Information gathered on the entire study area is mapped and used to select tentative transmission line routes. Transparent overlays of tentative routes are then superimposed on study area maps. Segments and corridors are analyzed in detail to determine the best route on an environmental basis.

form the basis for the boundary of the study area which, depending on the distance between terminals, may encompass from several hundred to several thousand square miles (Fig. 1). Initial selection of the study area is usually based on limited information supplied by maps. Obvious features that pose potential problems for transmission line routing are noted. Sections containing high mountain ranges, national parks or monuments, Indian reservations, primitive areas, or urbanized areas, for example, may be eliminated at the outset. Economics also plays a major role in the early phase of the process, for an extremely indirect route may make the project economically unfeasible. As more information about the region is gathered, boundaries of the study area may be changed to include new areas or to delete some sections.

After a study area has been initially determined, it is described in terms of its physical and cultural characteristics. This environmental information is later used to select tentative routes and also to assess the impact of the transmission line on the area.

GEOGRAPHICAL FACTORS IN TRANSMISSION LINE ANALYSIS

A great many factors—transmission line design, system engineering, noise, electrical effects, and cost-benefit studies, for example—that are part of an EHV transmission line analysis are removed from the realm of the geographer. The physical and cultural factors I present here, though, belong to disciplines more closely aligned with geography. Physical factors include physiography, geology, hydrology, meteorology/climatology, pedology, and ecology. The order in which these factors are discussed is not particularly important, except that description of the physical environment logically precedes that of the cultural aspects.

Physiography is important not only from an engineering and an economic viewpoint but also in its relationship to climate, soil erosion, vegetation, geology, and hydrology. Every geographer has had some exposure to physical geography and is thus familiar with the terms and the concepts used to describe terrain characteristics of the study area. Basic to a discussion of physiography is a description of the physiographic provinces in which the study area lies. This includes landforms, rock types, and stream drainages that characterize the physical landscape. Standard descriptions can be found in Charles B. Hunt's "Natural Regions of the United States and Canada" and in Nevin M. Fenneman's map of the "Physical Divisions of the United States."⁴ Altitude above mean sea level is obtained from U.S. Geological Survey topographic maps, which are produced at several standard scales. Maximum relief and representative local relief are determined. Shaded relief maps and raised-relief maps are available for many areas. Type of terrain and degree of slopes are described as well as the location, size, and flow characteristics of major rivers and creeks.

Geology is utilized primarily in solving engineering problems that involve foundation requirements, landslide hazards, and fault zones. Age, structure, and composition of rock strata, along with seismicity, are examined and briefly described. Unique geological features that may have scenic value or are prominent landmarks are identified. Geology is of only minor importance in transmission line projects, but it acquires major significance in such projects as the strip-mining of coal or the siting of nuclear power plants.

Similarly, hydrology is not usually a major concern in analyses of transmission line routing, but it is important to such projects as strip-mining, in which disturbance of aquifers over a large area may have wide-ranging effects on water supply. Characteristics of rivers and streams are noted: whether they are perennial or intermittent, and their greatest season of flow. Watersheds are described and runoff and infiltration data gathered. Aquifers are described and mapped, and well logs are examined to identify the availability of groundwater. Uses of groundwater for irrigation, municipalities, or stockpounds and sources of water and recharge rates are discussed.

Although they are not meteorologists, many geographers are familiar with the principles of climatology and meteorology. Climate relates to many of the other fields, such as land use, ecology, hydrology, and physiography as well as to engineering aspects of transmission line construction and operation. Data from nearby weather stations are usually available on temperature, precipitation, wind speed, and humidity. Intense rainfall can cause severe erosion, and heavy snowfall, lightning strikes, ice storms, strong winds, thunderstorms, hail, tornadoes, and other severe weather considerations can cause damage to towers and lines with resultant power outages. Frequency of these occurrences must be considered. Rainfall or snow on conductors can produce adverse electrical effects on the lines. Meteorological data are especially important in the environmental assessment of other related energy projects such as fossil fuel and nuclear power plants.

Pedology is a matter of concern because construction of the line and of access roads may accelerate erosion; and soil types also have a bearing on revegetation of the right-of-way. Soil groups are described and mapped in terms of texture, chemical concentrations, slope, and other physical and chemical characteristics. Potential erosion hazards are classified according to such physical properties as infiltration and permeability rates, chemical properties, degree and length of slopes, climate, natural vegetative cover, and ease with which disturbed areas may be revegetated. Degree of erosion hazard for soil groups is expressed in the relative terms of slight, moderate, or severe.

Ecology and biogeography are important in transmission line siting because sensitive natural biotic communities may be disturbed, not only through construction activities but also through the opening of new access roads into areas that previously were remote. Major biotic communities are identified and principal flora and fauna are described. Literature is searched

⁴ Charles B. Hunt: *Natural Regions of the United States and Canada* (W. H. Freeman Co., San Francisco, 1974); and "Physical Divisions of the United States" (U.S. Geological Survey, Washington, D.C., 1946).

and field surveys are conducted to determine whether threatened or endangered species are found in the study area. Biotic communities are ranked on a relative scale of sensitivity.

In addition to describing the physical characteristics of the study area, cultural aspects, including demography, land use, historical and archaeological sites, aesthetics, and a socioeconomic profile must be examined. To reduce visual impact, adverse electrical effects, and disruptions to existing land use, it is desirable from a demographic viewpoint to avoid populated places in siting transmission lines. Knowledge of the population in the study area is thus basic to an environmental analysis. Demographic aspects include population size, distribution, density, urban-rural ratios, and past and future growth trends, all of which are studied in population geography. Census data are gathered for regional, state, and county levels, for minor civil divisions, and for incorporated and unincorporated places. More detailed demographic information is also presented in the socioeconomic profile.

In preparing an environmental analysis the term "land use" is taken in its broadest sense to include land use patterns, land cover types, and the related aspects of landownership and land administration. Categories typically used are cropland, rangeland, forests, mining, transportation, utility corridors, urban land, natural areas, recreational lands, and "other land use types and subtypes." Many land use data can be obtained from maps published by the U.S. Geological Survey, the Forest Service, the Bureau of Land Management, the Federal Power Commission, and other federal, state or local agencies. In more remote areas published reports are often lacking, and local sources must be consulted. Supplementing these sources are aerial photography, aerial observations, and fieldwork. Land use patterns are described and mapped to show acreage estimates and linear measurements and to show the relationships among the different land use patterns.

Historical and archaeological information in an environmental report is usually presented in three sections, the first dealing with the culture history of the area, the second with the location of sites, and the third with archaeological potential. Discussion of the culture history frames an overview of significant events that occurred from prehistoric times to the present. Records are searched, and known archaeological and historical sites in the study area are described and mapped. A map of archaeological potential showing areas that have high, moderate, or low probabilities of containing additional sites is also prepared. Both maps are later used in the route selection process. Because of the large size of the typical study area, only a records search is performed for the entire area. Not until later, after a final route has been chosen using the route selection process, is a thorough field archaeological survey conducted. The most efficient means of obtaining archaeological and historical information is to retain a local consultant who is familiar with the area and with sources of data. Historical books and articles may be used to supplement the consultant's report. Charles R. McGimsey's study of "Public Archaeology" is a useful reference in dealing with recent archaeological legislation.⁶

Natural scenic quality is usually described in terms of the various elements that together characterize the study area: the diversity of topography, including any natural landmarks or unique geological features; the vegetative and wildlife species; color tones created by rock strata, soils, and vegetative cover; the amount of water available; and the number and type of man-made features in the area. A geographer, being familiar with the elements that are comprised in the total landscape, can categorize the study area as having high, moderate, or low scenic quality and can map it in these terms. The study area is surveyed from the air and on the ground, and representative features are photographed. Published brochures and pamphlets may also be available for well-known scenic areas. The Department of Interior, the Department of Agriculture, and the Federal Power Commission have published transmission line construction guidelines that include aesthetics.⁶

⁶ Charles R. McGimsey, III: *Public Archaeology* (Seminar Press, New York, 1972).

⁶ "Environmental Criteria for Electric Transmission Systems" (U.S. Depts. of the Interior and of Agriculture, Washington, D.C., 1971); and "Electric Power Transmission and the Environment: Guidelines for the Protection of Natural, Historic, Scenic, and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities" (Federal Power Commission, Washington, D.C., 1970).

A socioeconomic profile establishes a baseline of data that characterize the study area for a selected set of variables. Subjects typically studied include demographics, labor force and employment, school systems, municipal services, housing, retail sales, taxes, income, transportation accessibility, and recreational facilities. Many of the data are presented in tabular or graphic form. Commonly used sources of information include census data, reports, documents, questionnaires, surveys, and interviews.

SELECTION OF THE ROUTE

When the various physical and cultural factors of the entire study area have been examined, the route selection process begins. Based on the preliminary information, an initial set of alternative route segments, which avoid environmentally sensitive areas as much as possible, is established. In many cases existing utility lines cross parts of the study area, and these rights-of-way can often be paralleled in part by the proposed line. Paralleling existing utility lines minimizes land use conflicts, reduces the need for new access and maintenance roads, and mitigates other adverse environmental impacts. Usually half-mile- or mile-wide corridors are established on one or both sides of the proposed right-of-way centerline to allow for engineering flexibility in the final placement of the line. Alternative route segments are lettered for identification purposes and mapped (Fig. 1). Specific portions of the transmission line may then be referred to, for example, as Segment A-C or Corridor H-I. Transparent overlays of route segments are prepared and superimposed on the study area maps of physical and cultural features so that the segments may be compared with each other.

After initial route segments have been selected, each is analyzed in detail. For some disciplines such as climatology, geology, or hydrology, regional information may be adequate and no further data needed. For other fields, such as land use, population, soils, and aesthetics, it may be necessary to examine existing data in more detail or to gather additional information. For example, although the general categories of land use in the study area are known, aerial and ground surveys may be needed to determine specific land uses within the proposed transmission corridor segments. A summary table can be extremely useful in quantifying environmental information and in comparing various route segments.

Once detailed descriptions of the existing environment have been made for each proposed route and corridor segment, the environmental impacts of construction and operation can be estimated. Construction impacts are directly attributed to building the transmission line and are usually of relatively short duration. These include the effects of constructing access roads, cutting woodlands, crop damage, clearing and scraping the area, disruption of drainage, and other aspects of erecting transmission towers, stringing lines, and clean-up operations. In most cases construction guidelines are established that must be followed by the utility and its subcontractors to mitigate construction impacts. These guidelines must meet the mutual satisfaction of the utility and the environmental staff preparing the report. Many potential problems are avoided through strict adherence to these guidelines. Impacts due to operation are long-term environmental effects that occur as a result of the continued operation of an EHV line—cropland permanently removed from production or visual intrusion of the towers, for example.

After all route segments and corridors have been described and environmental impacts of each identified, perhaps the most difficult part of the analysis is undertaken: selection of the best route that has the least total environmental impact, ranking viable alternative routes, and eliminating unsuitable segments. Ranking of one route over another is based on an analysis of gathered data, on the combined knowledge of the staff who prepare the environmental report, on the opinion of local consultants involved with the project, and on input received from governmental agencies and concerned parties. Difficulties arise because many environmental factors are not easily quantified and because comparisons of environmental factors are subjective. For example, natural beauty or aesthetics is, in itself, difficult to quantify. Comparing aesthetics and ecology becomes even more of a problem. An urban planner may prefer a

transmission line built in remote areas away from the view of local residents, but an ecologist may prefer the line run through already disturbed areas nearer the development and away from pristine areas. Archaeologists are more concerned about potential disruptions of archaeological sites than about crop damage. Governmental bodies and individuals can often have restrictive viewpoints. One governmental agency is more concerned with impacts on their land than with impacts on governmental land owned by other agencies. A farmer may be deeply concerned about damage to drainage ditches in his fields but may give little thought to endangered species on his neighbor's property. Decisions must also be made as to the suitability of the corridors adjacent to the route segments. Some corridors as well as route segments may be unacceptable and are therefore dropped from further consideration. In some cases, for instance, where a transmission line already exists, a right-of-way adjacent and parallel to the existing line may be recommended because the area near the line already has been disturbed and because access roads have been built, but the wide corridor, extending well away from the existing line may be undisturbed land, and therefore may be environmentally unsuitable. All of these elements must be taken into consideration in selecting the best route and ranking alternative routes between transmission end points. Although this process is difficult and involves considerable subjectivity, decisions between one route or another can be made. Invariably, because many agencies and interested parties have their particular concerns, not everyone may agree on the recommended route selected by the environmental staff. However, these differences are usually resolved through compromises, and an environmentally acceptable EHV transmission line can be constructed.

A COMMENTARY ON CURRICULUM

As I stated in the introduction, this paper describes how to route an EHV transmission line on a sound environmental basis and illustrates how a geographer's educational background can be extremely valuable in performing environmental analyses. We must, however, look beyond these immediate objectives to consider two long-range goals that geographers must strive to attain. One of these is to improve our college and university curricula in applied geography, and the other is to educate business, industry, and government management to realize that geographers can perform valuable functions in their organizations.

Over the years, most geography departments have been oriented toward preparing their graduates for teaching careers. Alumni who were not interested in teaching were placed in that amorphous category known as "Liberal Arts" graduates. They rarely possessed any special job skills but were able to find meaningful positions because they held college degrees. Now, with the last of the post-World War II baby boom graduated from high school and with colleges reducing faculty because of soaring costs, the need for teachers has declined rapidly. The would-be teachers, along with the multitudes of liberal arts graduates, find it increasingly difficult to obtain meaningful work. Employers, faced with a large supply of college-trained people to choose from are now highly selective in their job placement programs.

Geographers can do a variety of things to improve the existing situation for all levels of graduates. In the first place, geography advisors should point out to beginning students that some courses are academically oriented while others have practical applications. A blend of types would seem appropriate. With current employment trends, however, there certainly is a need for stronger emphasis on applied geography. Courses should be organized that deal with real-world situations where students can use techniques such as problem solving, data organization and analysis, and decision making. Fieldwork is important, to learn not only physical techniques such as using a compass or measuring slopes but also skills such as selecting which data to gather and how to conduct interviews to obtain necessary information. Quantitative methods and cartographic skills are useful tools for a variety of positions.

Faculty members must not become isolated in academia but should maintain contacts with business, industry, and governmental personnel and should inquire as to the kinds of job skills that employers are seeking. Specific programs within geography can be designed to meet these

requirements while drawing on resources of other departments for related courses in surveying, geology, and economics, for example. Because geography has been associated with teaching for so long, and because most businessmen were exposed to geography only in elementary school, faculty members must explain to these managers that geography is much more than memorizing state capitals or locating place-names.

If geography departments, with the combined cooperation of geographers working outside academia, can enlighten industry and government as to our field, prospective employers will look on geography majors as individuals who have specific skills to offer rather than as would-be teachers or just more liberal arts graduates. Geography departments should also maintain lists of the types of companies or governmental agencies that have hired their recent graduates and should contact these alumni to ask them which skills are best suited for the work they are performing. In many cases, after a company hires its first geography major and discovers the capabilities and flexibilities of geographical training, the firm becomes knowledgeable about and receptive to the field.

The end result of these changes will benefit not only geography graduates but also businesses, geography departments, and the field of geography in general. Graduates will have more job opportunities and more satisfying careers. Businesses will benefit by obtaining personnel who can contribute innovative ideas, approaches, and viewpoints. As more geographers embark on careers outside academia, industry and government will develop a more accurate recognition of what geography represents. This in turn will stimulate new interest in the subject, which will help departments maintain their importance. All of these trends will benefit geography as a whole. Someday we may even rid ourselves of the commonplace industry, business, and government job titles such as scientist, representative, agent, or trainee and fill positions that hold the title "geographer."

GEOGRAPHICAL RECORD

PRELUDES TO SETTLING IN OUTER SPACE. Among the baffling topics on which geographers work is frontiers. They appear as spots, lines, or areas; they come into being quickly or slowly and disappear similarly; they are combinations or various kinds of isolation; they reflect economic, political, religious, or military interests; and they often include people with rather unusual characteristics. Furthermore, all of these traits change with time. Thus the opening of another major frontier, outer space, presents all disciplines with great challenges as well as with possibilities for solving problems now faced on earth.

The feasibility of humanizing outer space is new. Though fictionalized for more than a century, the colonization of space was not said to be practical until 1974. Then Gerard K. O'Neill, a physicist at Princeton University, published the seminal article suggesting paired cylindrical habitats, each 1 kilometer long and 200 meters in diameter, with a rotational periodicity of 21 seconds (to produce earthlike gravitational effects) and a land mass sufficient for 10,000 people. This is his Model 1, to be followed by larger ones culminating in Model 4, 32 kilometers long by 6,400 meters in diameter, with space for up to possibly 20 million inhabitants (The Colonization of Space, *Physics Today*, September, 1974, pp. 32-40). These are to be centered at or near L-5, a libration area in the orbit of the moon, where there is room for many habitats that would remain suspended in space.

Debate followed. In May, 1975, a conference covered further testing of basic concepts plus projections. Research proceeded rapidly. Now the expected steps to settling outer space are: moving to the moon by shuttle and tug; mining moon materials; slinging these by a mass driver to or near L-2 (another libration point) for processing; tugging the products to L-5; building satellite solar power stations (SSPSs) there; establishing the SSPSs in lower earth orbit (approximately 35,000 kilometers out); and beaming microwave power to earth receivers. Meanwhile, at L-5 each colony also is to produce another colony, as well as to manufacture products that can be made more easily or more cheaply than on earth. Some details of how to accomplish this are already available ("Space Manufacturing Facilities" [Amer. Inst. of Aeronautics and Astronautics, New York, 1977]).

Uses of outer space have been proposed for nearly two hundred years, with increasing degrees of accuracy (R. Salkeld: Space Colonization Now? *Astronautics and Aeronautics*, Vol. 13, 1975, pp. 30-34). This was paralleled by decreasing qualities of fiction as major "firsts" took place: Sputnik in 1957; the spaceship orbit of earth in 1961; the space treaty of 1967 (now signed by more than a hundred nations); the proposed SSPS in 1968; the moon landing in 1969; Skylab occupancy in 1973; public commitment of the National Aeronautics and Space Administration (NASA) to research outer space in 1976 ("Outlook for Space" [NASA, Washington, D.C., 1976]); and successful test flights of the Space Shuttle in 1977. In 1977, also, the Third Princeton Conference on Space Manufacturing Facilities was held, followed in October by a similar meeting in San Francisco. The year was marked further by the publication of four primary references on settling in outer space (F. Golden: Colonies in Space [New York, 1977]; T. A. Heppenheimer: Colonies in Space [Harrisburg, Pa., 1977]; "Space Settlement" [L-5 Society, Tucson, Ariz., 1977]; and G. K. O'Neill: The High Frontier [New York, 1977]).

Now all signs are that the colonizing of outer space is feasible with present technology, including what is on the drawing board (such as the Space Tug for transport from a lower-earth orbit to higher ones). Not only has getting to outer space and back been worked out in general but some details of occupancy and self-sufficiency have been proposed in order to estimate the logistics of initiation. For example, five shapes of habitat have been proposed, from cylinder through hatbox, torus, and sphere to sunflower. Capturing, mining, and processing asteroids (in addition to creating living space in them) is being considered. The production of grains and small animals (such as rabbits) for self-sufficiency has been proposed. Political structure is being studied. And the existence of markets on earth for specialized products, such as ball bearings, transistor chips, and pharmaceutical products (as well as for electric energy)

have been analyzed in relation to the costs of production in space. Furthermore, a profit is expected approximately thirty years from the start.

In the past new frontiers have often attracted strong-minded individuals, some impulsive and some poorly prepared. Real planners were few. This is not so here. Because initial efforts involve leaving the 4,000-mile-deep "well" of earth's gravity, it is essential to have estimates of every item needed for self-sufficient colonizing; moreover, the assumed isolation of outer space requires safety allowances. Thus most proponents of this activity are "spacenuts," in the best sense, who are objective, serious, calm, and open minded. The salesmanship of past frontiers is missing—how refreshing!

Clearly, to get this far has required major efforts in engineering and related disciplines. Our colleagues have done well: bibliographies of analyses and tests are long and support the assumptions of weights, thrusts, and orbits. It is understandable that physical scientists are ten years ahead of their associates in social planning. After all, one must first get off the earth.

Now it is time for more complete planning on the human side. Mining and transportation in outer space need the input of economic geographers. Treaties can be clarified by political geographers, for mining in outer space has become as complicated as that of our open seas. In a space habitat settlements may be scattered as well as concentrated. The use of outer space settlements as eventual releases for densely populated parts of the earth requires analyses from both topical and regional geographers; after all, our principal population concentrations are poorer and less mobile than others. Thus a desirable internationalization of colonizing requires much supporting study. Furthermore, colonizing outer space demands refined geographical knowledge on the part of planners, who must be experienced in analyzing, and probably living in, different worldwide degrees of isolation.

In distribution of population we may be at a major turning point in earth history. Instead of three-dimensional distributions we may become at least four dimensional. One estimate is that 10 million people may be living at L-5 by 2025; another suggests that more Americans may be living in space than in their home country by 2076. And, of course, this leads to thoughts of uniting states in space, of independence from earth, and of moving on out into the solar system. Research on settling outer space is moving so rapidly in so many different directions that whole disciplines may be left behind inextricably within a year if they do not take formal steps to keep up.—KIRK H. STONE

THE ICEBERG SOLUTION. The First International Conference on Iceberg Utilization, held at Iowa State University early in October, 1977, has reawakened public interest in an idea advanced in the 1940's by John Isaacs of the Scripps Institute of Oceanography. Few took Isaacs's proposal seriously, and little was attempted in the way of rigorously evaluating the technical or economic feasibility of towing icebergs to areas of water shortage. In an increasingly thirsty world, however, it was unlikely that the polar ice caps, which represent roughly 80 percent of the world's freshwater supply, would for long escape the designs of planners. In the arid zones in particular, the demand for increased, more reliable supplies of good-quality water, together with the expanded and multifaceted role of water in human and economic development programs, has intensified existing supply/demand imbalances. Augmentation of the locally available supply (as opposed to measures intended to promote conservation and more efficient use of the existing supply) has been the traditional method of resolving shortages. From this perspective, the proposal to tow icebergs from the polar ice caps to water-deficit regions is the logical next step in a development sequence that has led water planners from intrabasin through interbasin to intercontinental water transfer projects.

Scientific interest in icebergs as a potential source of freshwater resurfaced in the early 1970's. For the first time it was argued that the idea appeared both technically feasible and economically attractive (W. F. Weeks and W. J. Campbell: Icebergs as a Fresh Water Source: An Appraisal, *Journ. Glaciology*, Vol. 12, 1973, pp. 207-233). The use of Earth Resources

Technology Satellites was advocated as a method of assessing supply and locating suitable icebergs (J. L. Hult and N. C. Ostrander: *Applicability of ERTS for Surveying Antarctic Iceberg Resources*, Rept. No. R-1354-NASA/NSF, Goddard Space Flight Center, Greenbelt, Md., 1973). Preliminary estimates suggested that the cost per acre-foot of water delivered would be a third that of desalinated water and half that of water imported to Southern California from out-of-state sources (J. L. Hult and N. C. Ostrander: *Antarctic Icebergs as a Global Fresh Water Resource*, Rept. No. R-1255-NSF, Natl. Sci. Foundation, Washington, D.C., 1973). In contrast to these proposals, which essentially envisaged the transport of icebergs to water-deficit regions of the Southern Hemisphere, the impetus for the Iowa conference stems from the problems presently confronting water planners in Saudi Arabia.

Traditionally, water development in the Arabian Peninsula has emphasized agricultural needs and has relied on local surface and groundwater sources. Only a decade ago most urban communities still depended on wells, springs, and rainwater cisterns for domestic water supply, the water frequently being conveyed in open surface conduits to centrally located tanks or fountains from which the townspeople and water carriers would draw their daily requirements. In the past ten years, however, the rapid pace of urbanization, combined with the high rate of government investment in water supply and sewage-treatment facilities, has meant that local supplies have been heavily overdrawn. Despite efforts to develop alternative sources (most notably desalinated water), a growing disparity exists between the effective supply of and the demand for water in major cities such as Jeddah and Riyadh. Moreover, although irrigation remains the largest consumer of water, the current development plan anticipates a 158 percent increase in urban water demand, from the present 211 thousand cubic meters per day to 545 thousand cubic meters per day by 1980 ("Development Plan, 1395-1400" [Central Planning Org., Riyadh, 1974], p. 103).

The basic strategy adopted by the Saudi government to meet urban water needs has been to develop groundwater sources in inland locations and to construct desalination plants along the coast. Six desalination plants, with a total capacity of nearly 50,000 cubic meters per day, are now in operation, and a seventh plant (at Jubail on the Gulf coast) is due to come on-stream early in 1978. In an attempt to keep pace with demand, the 1975-1980 development plan called for an investment of more than \$7 billion in construction and expansion of desalination facilities, including the first inland plant to demineralize brackish groundwater. This crash program would have provided an additional 535,000 cubic meters per day, approximately ten times the present installed capacity, by 1980. Projects to be initiated during the period of the plan but scheduled for completion after 1980 provided for a further doubling of installed capacity. Considerable uncertainty now surrounds this ambitious program, following the withdrawal by the Saudi Saline Water Conversion Corporation in 1976 of all invitations to tender for desalination study, design, and construction contracts. Although invitations to bid on the next stage of the Jubail and Jeddah plants were reissued early in 1977, it seems probable that the tremendous burden imposed by these and other development projects on available manpower, services, and supplies has necessitated a rephrasing of the construction program.

Under these circumstances the desperate search for freshwater encompassed the possibility of towing icebergs from the Antarctic. A preliminary feasibility study was completed for the Saline Water Conversion Corporation by the Centre d'Information Commerciale et Économique et de Recherche Opérationnelle (CICERO) in 1976. In detail, the proposal differed little from that previously advanced by Hult and Ostrander. In a paper delivered at the United Nations Conference on Water in Buenos Aires in March, 1977, the then director of the Saline Water Conversion Corporation, Prince Mohammed al-Faisal, described the iceberg project as a complement to the government's desalination program, arguing that projected requirements could not be met solely from desalination plants (Prince Mohammed al-Faisal: *Water Supply and Weather Modifications through the Use of Transported Icebergs from the Antarctic*, p. X-1, 2). Based on the CICERO study, the cost of water delivered to Jeddah from even relatively small icebergs (approximately 100 million cubic meters) would be in the order of \$0.54 per cubic meter. Although this figure is substantially higher than the estimates given by

Hult and Ostrander, it compares favorably with the \$0.80-per-cubic-meter cost of desalinated water in Saudi Arabia today. Moreover, the CICERO report suggested that substantial indirect benefits, including relief from the oppressive summer heat and reduction in the peak demand for water and electricity, would be derived from the cooling effect of icebergs on local weather. Major problems identified in the report include protection of the icebergs against excessive melting during transit and navigational hazards associated with maneuvering an iceberg with a draft of approximately 250 meters through the Bab el Mandeb Straits. The former problem is to be minimized through the use of plastic covers and/or spraying with urethane foam, though the effectiveness of such measures was seriously questioned at the Iowa conference. Navigational problems are to be resolved by slicing the icebergs into smaller segments using "thermal drilling and thermal cutting" (Faisal, *op. cit.* [see above], p. X-1, 5).

The iceberg solution favored by Prince Faisal was not unopposed within the Saudi government. In December, 1976, for example, the minister of agriculture and water denied that icebergs would be brought from the Antarctic to supplement Saudi freshwater supplies, emphasizing that government policy was to concentrate on desalination of seawater and development of the nation's groundwater resources. The resignation of Prince Faisal as director of the Saline Water Conversion Corporation to head a private company, Iceberg Transport International, would appear to confirm the lack of enthusiasm for the project in government circles. Moreover, in July, 1977, the Ministry of Agriculture and Water announced an accelerated construction program, including seven small desalination plants not included in the budget for the development plan, to relieve the water shortage in Jeddah.

As the gap between the available supply of and the demand for water widens, there is little evidence of any attempt to modify existing patterns of management or consumption. Yet it is apparent that much of the available supply is used wastefully. One recent estimate is that of the 88,900 cubic meters per day currently fed into the Jeddah supply system from surface sources and desalination plants, approximately 13,200 cubic meters per day are being used for construction purposes, 15,100 cubic meters per day are lost through leakage from the distribution network, and an additional 5,700 cubic meters per day seep from the main pipeline—quite apart from the extravagant use of water for lawns, gardens, and swimming pools (*Middle East Econ. Digest*, Vol. 20, June 18, 1976, p. 31). The proposal to moor icebergs off Jeddah—and the intention is to have the first iceberg in place by 1980—illustrates the continued interest in more exotic ways of solving water shortages. If the scheme is implemented, Alfred Lord Tennyson's assertion in his epic poem, "The Coming of Arthur," that "a doubtful throne is ice on summer seas" will truly be put to the test.—IAN R. MANNERS

REPORT ON THE MACKENZIE VALLEY PIPELINE INQUIRY. Royal commissions are proclaimed with great fanfare, but their reports are filed quietly and rarely, if ever, read. An exception is Thomas R. Berger's "Northern Frontier, Northern Homeland: The Report of the Mackenzie Valley Pipeline Inquiry: Volume One" (Supply and Services Canada, Ottawa, 1977). Justice Berger, of the British Columbia Supreme Court, has written a challenging report on "the broad social, economic, and environmental impacts that a gas pipeline and an energy corridor would have in the Mackenzie Valley and the Western Arctic." It contains his personal summary and recommendations after three years of investigation by the Mackenzie Valley Pipeline Inquiry, of which he was the sole commissioner. Well written and beautifully illustrated, the report will be read long after the pipeline routes are established.

The basic purpose of the inquiry was to help the government of Canada decide which natural gas pipeline route across northern Canada to approve. It studied the proposal of Canadian Arctic Gas Pipeline Ltd. to build a pipeline from Prudhoe Bay across northern Alaska and the Yukon to the Mackenzie Delta, southward up the Mackenzie River to the existing pipeline system in Alberta, and ultimately to the midwestern United States. The competing proposal, from Foothills Pipe Line Ltd., suggested a pipeline only southward from the delta. Both of these proposals have now been abandoned. Although not within his terms of

reference, Berger's findings have had important implications for the Alaska Highway (Alcan) pipeline proposal. In fact, Berger did much to shift attention in Canada to the Alaska Highway route.

Berger understands correctly that the real issues in the Canadian North are the fundamentals of development: economic, social, cultural, and environmental change. These issues concern the fate of a region and its peoples and overshadow the immediate problems of pipeline route selection.

We are now at our last frontier. It is a frontier that all of us have read about, but few of us have seen. Profound issues, touching our deepest concerns as a nation, await us there.

The North is a frontier, but it is a homeland too, the homeland of the Dene, Inuit and Metis, as it is also the home of the white people who live there. And it is a heritage, a unique environment that we are called upon to preserve for all Canadians.

The decisions we have to make are not, therefore, simply about northern pipelines. They are decisions about the protection of the northern environment and the future of northern peoples.

Berger proposes slow and careful economic development for the North. He recommends that a Mackenzie Valley pipeline be postponed for ten years and that no pipeline ever be built across the northern Yukon. Native land claims must be settled first, and an orderly program of oil and gas exploration must determine the exact extent of the reserves in the Mackenzie Delta and the Beaufort Sea. A massive construction project like the Mackenzie Valley pipeline would bring limited economic benefits but would have a devastating social impact. Thus more time is needed to plan for orderly development for all the people of the North.

Oil and gas exploration continues in the Mackenzie Delta, offshore in the Beaufort Sea, on the arctic islands, and in various other locations throughout the Northwest Territories. No pipelines will be built up the Mackenzie River in the foreseeable future because the present proven reserves of both oil and gas are not sufficient to justify their construction. The addition of Alaskan oil and gas was necessary to provide the volume to make these pipeline routes viable. However, there are active plans to transport natural gas from the arctic islands southward, either east of Hudson Bay through Quebec or westward through Manitoba. These activities in the eastern Arctic were not within the terms of reference of the inquiry.

The inquiry was long and complex. It involved thousands of people, using seven languages, in formal hearings in Yellowknife and Ottawa, informal community hearings in thirty-five northern towns and hamlets from Old Crow to Sachs Harbor, and ten formal public hearings in southern cities from Vancouver to Halifax. The full record of the proceedings includes 281 volumes of testimony and exhibits. A six-volume summary and a key-word index have been published by the Department of Indian Affairs and Northern Development. Although few people will want to read all of this, the inquiry examined many aspects of northern life, from native land claims and socioeconomic development to the biology of caribou and the white whale.

The most remarkable portions of the testimony came during the community hearings from the people of the North, who often expressed eloquently and passionately their views on the pipeline and its impact on their lives. Chief Frank T'Seleie of Fort Good Hope proclaimed:

We are like the river that flows and changes, yet is always the same. The river cannot flow too slow and it cannot flow too fast. It is a river and it will always be a river, for that is what it was meant to be. We are like the river, but we are not the river. We are human. That is what we were meant to be. We were not meant to be destroyed and we were not meant to take over other parts of the world. We were meant to be ourselves, to be what it is our nature to be.

The fundamental issue was cultural survival, as Chief Paul Andrew of Fort Norman remarked.

We want to survive as a nation and we want to be left alone as a nation. We wish to survive in the future. We wish for our children to survive in the future. We wish for the upcoming generation to survive in the future, and for them to carry on our identity, our language, and our culture. No man in his right mind would say, here, jeopardize my future. Jeopardize the people, the future of the upcoming generation. No man in his right mind would say that. And that is what you are asking us to say by the proposed pipeline.

Berger heard everyone in the local communities who wished to speak. Sometimes almost the entire adult population of a hamlet would testify. Often the most dramatic and effective statements were the shortest and the simplest. "I am against the pipeline," young Harvey Kassie of Old Crow testified. "My mother's a trapper; she goes to Crow Flats every year. I go with her every spring and I would like to do the same things as her when I grow up. That's why I am against the pipeline. Thank you."

As important as the North is, it is a distant frontier. Few residents of the South, the beneficiaries of the natural gas, understand the impact of the petroleum industry in the Arctic. Thus a direct comparison by Rainer Genelli of Whitehorse was particularly effective and was broadcast widely by the southern media:

I wonder how people in Toronto would react if the people of Old Crow went down to Toronto and said, "Well, look, we are going to knock down all of these skyscrapers and high rises . . . blast a few holes for lakes to make way for muskrat trapping. Your people are just going to have to move out and stop driving cars and move into cabins."

Responses of the natives varied, but they were overwhelmingly against the pipeline proposals.

Throughout this process Berger set an example for all. Praised by corporation lawyers and native leaders alike, he demonstrated the skill of the politician that he was and maintained the dignity of the judge that he is. The most lasting impact of the inquiry may well be its influence on the public hearing process *per se*. Berger has set a new standard for public participation, for openness and accessibility to the people, and for investigative thoroughness, especially in the quality of socioeconomic and environmental impact studies, which do not have the status in law in Canada that they do in the United States. The greatest tribute to Berger is not that the Mackenzie Valley pipeline will not be built but that others faced with large projects are calling for "Berger-like" hearings on the socioeconomic and environmental implications of their particular controversies.

The immediate battles concerning oil and natural gas pipelines in Alaska, the Yukon, and the western Arctic are almost over. But "Northern Frontier, Northern Homeland" will not become just another dust-collecting government document. It has lasting value as a statement on the character and future of arctic life.—TERRY SIMMONS

UNCERTAINTY IN THE SEYCHELLES. In 1976 this archipelago—eighty-six mainly rugged granitic islands, with a land area of 107 square miles distributed over about 400,000 square miles of the equatorial Indian Ocean—ceased being a British colony and became an independent republic. Although it was discovered by the Portuguese in 1501 and was settled by Frenchmen and their African slaves in 1770, the archipelago, located off regular shipping lanes, remained virtually undeveloped. Its 60,000 inhabitants (1976 estimate) lived poorly on subsistence farming and on limited as well as fluctuating exports of copra and cinnamon. Owing to this poverty the British government, which took the islands from France in 1810, paid for most of the administration and subsidized imported food, mainly rice, and external and internal transportation services.

Conditions changed in 1968, however, when the British government agreed to pay for construction of an airport, the first in the archipelago, in exchange for cession by the Seychelles of several strategic outer coral islands (organized since then into the British Indian Ocean

Territories). Construction of the airport was expensive, for coral reefs near the shore had to be filled in to accommodate the runways. Simultaneously, roads, sewers, reservoirs, and a port suitable for the berthing of 20,000-ton vessels, as well as hotels and other facilities, were built. When the airport opened in 1971 the Seychelles immediately became a tourist area, which by 1976 accommodated an estimated 45,000 visitors ("A Review of the Economy" [Govt. Press, Victoria, Seychelles, 1976]). Several daily flights now connect the Seychelles to Europe (via East Africa or the Middle East), and flights leave almost daily for the Far East. Three flights a week provide good connections to South Africa and Australia.

Almost all of the tourist and associated development has been concentrated on the main island, Mahé (fifty-nine square miles, with an estimated 52,000 inhabitants in 1976), where the airport, port, and the capital, Victoria (population 20,000), are located. Of the other islands only Praslin, with its coco-de-mer tree reservation, attracts significant numbers of tourists—most of whom spend only a few hours there. With the development of tourism, per capita income was estimated to have increased to about \$411 in 1976, having probably quadrupled since 1968 (interviews in the Office of the Prime Minister of the Seychelles, 1976), and Victoria acquired a central business district.

During the period of construction, a large volume of supplies reached the Seychelles, mainly by charter ships. With the termination of construction between 1973 and 1976, this volume was gradually reduced, making the frequent charter of ships, as required for tourist and other supplies, no longer economical. Although air freight can be used for some imports, it is not economical for bulk supplies and for the requirements of the resident population. The shipping problem was aggravated in 1976 by the termination of the ocean liner service connecting India and East Africa. Since the late nineteenth century this service had been the archipelago's only regular link with the outside world. The geographically diverse origin of Seychelles imports is another complicating factor in making shipping arrangements: industrial goods and processed foods come mainly from Europe and the Far East, but some construction materials and basic foods come from East Africa and South Africa as well as from Australia. The problem is aggravated by the recent increase in the size of available ships. It is now uneconomical to off-load small cargoes at ports away from regular routes. To induce a sufficient volume for use of larger ships, the government considered raising tourist accommodations from the present 1,700 beds to 3,500. An expansion of this magnitude would have entailed additions to road capacities, reservoirs and sewers, golf courses, and so forth. The already limited areas of agricultural land would have been reduced significantly, and use of the superb beaches, which are the main tourist attraction, would have been greater—if not excessive. For reasons of both cost and reduction of amenities, this plan was rejected.

Instead, the Seychelles government hopes to increase its revenues by making the republic a tax haven where foreign corporations or individuals can register their headquarters at low tax rates, similar to the scheme in the Cayman Islands (Alexander Melamid: Development in the Cayman Islands, *Geogr. Rev.*, Vol. 65, 1975, pp. 107–108). These tax concessions are expected to have a significant appeal to investors in the Far East and in the Middle East. The revenues from this venture are to subsidize development and services in the republic, but they will probably not be sufficient to provide for satisfactory transportation arrangements. Simultaneously, unemployment—which even during the period of maximum construction never fell below 11 percent—increased to very high levels, probably in excess of 25 percent in 1976 (interviews [see above]). Thus for reasons of its location and its relatively large and rapidly growing population (2.4 percent in 1974; calculated from "A Review of the Economy" [see above], p. 43) this physically most attractive republic faces an uncertain economic future. Political doubts regarding this future were also raised after a radical group took over the government of the islands in a simple, almost nonviolent, coup in June, 1977, and suspended the democratic constitution. Little is known about the political affiliation of these radicals; and nothing was done by November, 1977, to upset the existing tourist and financial arrangements, which, together with some continuing British government aid, continue to provide all the revenues of this republic.—

ALEXANDER MELAMID

MANUFACTURED EXPORTS FROM THIRD WORLD COUNTRIES. Over the past decade manufactured goods have become a major new export of the Third World. Developed capitalist countries are the principal customers. The United States was the first to increase imports from this source: in 1967 manufactures accounted for only 26 percent of its total imports from the Third World; by 1973 the figure had grown to 40 percent. Mexico and Taiwan have come to supply the United States with more manufactured goods than such industrialized nations as France or Italy. Since 1973 the proportion of manufactured goods in Third World exports to the United States has continued to grow in physical terms, but price increases for certain commodities—particularly oil—have decreased the proportion of manufactures when measured by value (Jeffrey W. Lins: *U.S. Trade with the Developing Economies: The Growing Importance of Manufactured Goods*, *Staff Econ. Rept. #9*, Domestic and Internatl. Business Admin., Dept. of Commerce, Washington, D.C., 1975).

The original spurt of United States imports of manufactures from the Third World was caused by the dollar devaluation of 1971. Labor-intensive products from Western Europe and Japan became expensive in the United States, and they were soon replaced by similar items made in Third World countries which had also devalued. Subsequently, however, Western Europe and Japan have come to import many of these same labor-intensive products. Footwear, textiles and apparel, and optical equipment are prime examples (see, for example, Tracy Dalby: *Textiles: Diversify to Survive*, *Far Eastern Econ. Rev.* (Hong Kong), Dec. 24, 1976, pp. 51 and 53; and Beronique Maurus: *Anarchy in Textiles*, *Manchester Guardian Weekly*, Dec. 5, 1976, p. 13). Third World countries have also come to export such new high-technology items as digital calculators and watches.

The willingness on the part of developed capitalist countries to import manufactures from the Third World represents a radical change of policy. Only a dozen years ago the United States announced that it was unwilling to permit domestic labor-intensive industries to succumb to competition from low-wage countries (George W. Ball: *Diplomacy in a Crowded World* [Atlantic Monthly Press, Boston, 1976], p. 282). Now the administration refuses to entertain the demands of organized labor to stop the "export of jobs" ("Should the U.S. Curb Imports?" *U.S. News and World Report*, Aug. 8, 1977, pp. 25–26). With the exception of Italy, the industrial countries of Western Europe and Japan have rejected similar protectionist demands. Concern about the inflationary consequences of protectionism partly accounts for this reversal of policies.

But the influence of multinational corporations (MNCs) is probably more decisive. In the 1950's and 1960's, encouraged by protectionist industrial policies of developing countries, manufacturing concerns domiciled in the rich countries created subsidiaries and joint ventures throughout the Third World. These Third World subsidiaries became major markets for machines, semimanufactures, and technology produced in the rich countries. The next logical step was for individual companies to internationalize production of complex products by locating labor-intensive processes in low-wage countries and capital-intensive processes in high-wage countries (Stanford Rose: *The Poor Countries Turn from Buy Less to Sell More*, *Fortune*, April, 1970, pp. 90–93 and 169–170; and *idem*, *U.S. Foreign Trade: There's No Need to Panic*, *ibid.*, August, 1971, pp. 109–111 and 186–189). As a result, international trade in manufactures is becoming intracompany trade among subsidiaries of huge MNCs—a fact that raises new issues in the management of national economies ("U.S. Economic Growth from 1976 to 1986, Vol. 12—Economic Growth in the International Context" [95th Congr., 1st Sess., Joint Economic Committee]).

Although Third World governments are concerned about the economic power of MNCs, most view increasing exports of manufactured goods as an economic cure-all. Many countries are too small to industrialize using only their national markets, and for those with massive unemployment labor-intensive industries have obvious attractions. Developing new exports also means increasing foreign exchange earnings, long a major policy objective of developing countries but one which has taken on added urgency for those that import fuel.

However, it is questionable whether the current phase of export-oriented industrialization can really be called "development." Low wages have become a critical asset: countries that fail to keep wages below a given ceiling will lose industries to other countries. However, beyond a certain point low wages conflict with the goal of raising standards of living—supposedly the *raison d'être* of economic development. In Southeast Asia, where initial wage levels are very low, it has been possible to attract low-wage industries and to increase standards of living. But even under parliamentary regimes such as Hong Kong and Singapore labor is unorganized or it is kept on a short leash, and Singapore imports foreign workers rather than permitting growing industrial employment to push wages up (Brewster Grace: *The Politics of Income Distribution in Singapore*, *Amer. Univ. Field Staff Reports, S.E. Asia Series*, Vol. 25, 1977).

In South America turning to export-oriented industrialization may actually imply a lowering of wages and of standards of living. The southernmost countries of this region have created diversified, but high-cost, industrial economies behind walls of protective tariffs. Wages are higher than in Africa, Asia, or the smaller countries of Central America and the Caribbean.

Chile is one of these advanced South American countries. It began to industrialize around World War I. By the mid-1950's further industrialization had become difficult. The domestic market for manufactured goods was saturated, partly because the small size of the country meant that consumer industries produced low volumes at high costs. Not even high prices for traditional exports could fuel further industrial expansion aimed at supplying the home market (Aníbal Pinto: *Chile: Una economía difícil* [Fondo de Cultura Económica, Mexico, 1964]). Under Presidents Frei and Allende, Chile became a leading proponent of the Andean Common Market, but only since the coup of 1973 has the country achieved major growth in industrial exports. Under the military government Chile has also withdrawn from the Andean Common Market—which means that its exports must compete on a world basis—and wages and the standard of living have declined (David H. S. Hoelscher: *Structural Changes in Chilean Trade Patterns*, *Inter-Amer. Econ. Affairs*, Vol. 31, Summer, 1977, pp. 65-75; and Richard Lagos and Oscar A. Ruffatt: *Military Government and Real Wages in Chile*, *Latin Amer. Research Rev.*, Vol. 10, 1975, pp. 139-146).

Of course no country actually plans to "achieve" permanent inferiority. The intent is to begin with low-wage industries and to "trade up" to high-wage industries. However, the prospects of trading up are becoming more remote. Low-wage industries do not necessarily create the knowledge and infrastructure required by high-wage industries. The latter tend to be newly developed industries, and to create them a country must have its own research and development capabilities. But unrestricted import of technology from rich countries during the low-wage stage both discourages research in the poor countries and subsidizes further research in the rich countries. It thus assures the technological inferiority of "developing" countries (Richard J. Barnet and Ronald E. Muller: *Global Reach: The Power of the Multinational Corporations* [Simon & Schuster, New York, 1974], pp. 162-172).

High-wage industries also require a diversified industrial infrastructure. Low-wage industries can promote development of this infrastructure only if they are integrated with the local economy. But the tendency is to locate export industries in special zones to facilitate duty-free import of foreign equipment and components. Mexico, Taiwan, South Korea, and other countries have established these special zones, and, on an international scale, the city-states of Hong Kong and Singapore can be considered foreign industrial enclaves. In Taiwan foreign imports can account for up to 80 percent of the value of products manufactured in the Kaohsiung Export Processing Zone (Ching-yuan Lin: *Industrialization in Taiwan, 1946-72* [Praeger, New York, 1973], pp. 107-108). These industrial enclaves can no more stimulate general economic development than the mining and plantation enclaves did during the colonial period.

Haiti possibly represents the epitome of present trends. Since 1970 it has attracted more than a hundred new export-oriented industrial firms, yet it remains one of the most backward countries in the world. Its "assets" are a stable government that provides tax relief and similar

cost-reducing aid to would-be exporters, and extremely low wages—the latter a product of its backward economy (Thomas K. Morrison: Case Study of a “Least Developed Country” Successfully Exporting Manufactures: Haiti, *Inter-Amer. Econ. Affairs*, Vol. 29, Summer, 1975, pp. 21–31). Are we not witnessing the emergence of a new variety of country, one which is both industrialized and underdeveloped?—CHARLES W. KOCH

PLANNING THE DEATH OF GROWTH—CAN GEOGRAPHERS HELP? In October, 1977, George Mitchell, a Texas oilman, gave out five \$10,000 prizes for essays on “Alternatives to Growth.” With the assistance of Dennis L. Meadows and Willem P. J. Boichel, a conference on this subject was cosponsored by the Club of Rome, the University of Houston, and the Mitchell Energy and Development Corporation at The Woodlands, Texas, October 2–4, 1977. Another conference and prizegiving on the same general topic will be held in October, 1979. Two more conferences and sets of prizes are to follow, in 1981 and 1983.

Mitchell is investing some of his oil revenues in The Woodlands, a new planned community twenty-five miles north of Houston. He is also concerned about the future of our society once it is no longer possible to increase the consumption of energy each year. Many major oil companies were represented at the conference; these other oilmen made the most of every opportunity to give papers and to make comments to the effect that we should continue doubling our use of energy every ten years or America would be abandoning the tradition of growth that has made it great. Several prominent political figures, including Thomas P. O'Neill, spoke at the conference, but they too were not convinced that alternatives to growth exist.

Aurelio Peccei, chairman of the Club of Rome, was most effective in presenting the case for developing some new kind of sustainable society before the one in which we are living collapses when energy, food, and material goods become too expensive for most people to buy. Russell W. Peterson, president of New Directions, former chairman of the U.S. Council on Environmental Quality, and former governor of Delaware, said that trying to help the world's poor, who already suffer from lack of resources, by encouraging big industry is about as effective as pushing on the end of a wet noodle. Most people seemed to realize that to rely on price rises as a method of allocating increasingly scarce resources will magnify the social inequities that already exist. Many speakers talked about the need to provide social justice during the period of transition to a sustainable society.

The conference began with an impressive display of computer capabilities, in which a television projector showed on a large silver screen the printout from a computer at Case Western Reserve University in Cleveland. The five hundred participants in the conference could easily see the graphs and tables, which were similar to those in “The Limits to Growth” (Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, and William W. Behrens III; Universe Books, New York, 1972). The computer was asked when the world would run out of oil if known reserves were twice as large as they are now. It quickly produced a plunging graph that hit bottom only a little farther along in time than the previous graph. The computer was unable to come up with any likely scenario that would prevent massive starvation in India by 2025 or widespread death from starvation there in the 1990's.

Herman Kahn, director of the Hudson Institute, who kept many people worried for years with military concepts like “anticipatory retaliation,” is now belittling environmentalists and conservationists. He spoke effectively and amusingly but was unable to convince everybody that science will come up with new, cheap sources of energy so that the United States will not suffer economically, as other countries have. His contention that those who are worried about the future have constituted themselves into some kind of irresponsible intellectual elite may not have been the most effective approach to convince this particular audience.

In addition to these plenary sessions, fifteen workshops were held in four concurrent sessions. Discussions took place on topics such as population, ethics, energy, ecology, econom-

ics for a sustainable no-growth society, resource management, problems of making the transition from our present social system to some other social system, the role of modern corporations, and sustainable agricultural practices. The workshops were generally excellent and of much interest to geographers. One of the more fascinating confrontations was between Gordon Millar, vice-president for engineering of John Deere and Company, and Wendell Berry, who uses only horses on his farm in Kentucky. Both men were convincing and articulate, and they became so frustrated that they resorted to name-calling.

Underdeveloped nations were well represented at the conference. It is difficult to imagine, for me at least, how such good worldwide representation was achieved when many geographers in this country seem not to have been aware of the Mitchell prize contests and of The Woodlands conferences. Information on the 1979 competition can be obtained by writing to Mitchell Prize, Box 58, Plainfield, New Hampshire 03781. Geographers, consider this an exhortation!—DONALD Q. INNIS

GEOGRAPHICAL REVIEWS

COMPUTING FOR GEOGRAPHERS. By JOHN A. DAWSON and DAVID J. UNWIN. 362 pp.; maps, diagrs., bibliogrs., index. David & Charles, Newton Abbot, London, and Vancouver; and Crane, Russak & Company, Inc., New York, 1976. \$12.95. 8¼ x 5¼ inches.

From the licensing and registration of automotive vehicles and visual display printouts of the location and frequency of crime in the streets through ultrasophisticated computer programs designed to guide and land space vehicles with pinpoint accuracy on distant planets, the computer has permeated every aspect of our society. Yet as recently as three decades ago the computer was still in an embryonic stage of development.

Young geographers who take the computer for granted might have had some second thoughts about the ultimate success of this revolutionary device had they been introduced to the occasionally awesome and frequently unmanageable predecessors of the modern-day computers. I wonder how the practitioners would have reacted if they had encountered the first fully electronic computer, called the Electronic Numerical Integrator and Computer and immediately dubbed the ENIAC, that was built at the University of Pennsylvania in 1946 for the United States Army. The machine was huge by present standards; it occupied an area of 1,500 square feet, had approximately 18,000 vacuum tubes, and required a prodigious 130,000 watts of power. Tube burnouts and mechanical and electrical failures in the early days of computer technology were so common that a computer was as frequently inoperative as it was operative.

Toward the end of the 1950's transistors replaced vacuum tubes and spawned a new generation of smaller, lighter, and far more reliable computers. For the first time computers worked more often than not. Revolutionary advances in computer hardware technology continue unabated. Magnetic memory devices twenty-millionths of an inch across are commonplace, and circuits even smaller are being mass-produced. Computer circuitry has become so tiny that it is installed with the help of optical and even electron microscopes. Directly related to these innovations is the fact that computers are shrinking in size and cost at a rate never before attained in their thirty-year history.

Of primary concern to Dawson and Unwin is software. Their tightly structured, software-oriented text is designed to introduce geography students to the intricacies of programming in FORTRAN by emphasizing physical and cultural problems of the type commonly encountered in geography. If the book had been published a decade or so ago, it probably would have been in immediate demand, for until the mid-1960's there was a paucity of programs with direct utility to undergraduates and beginning graduate students in geography. All of that has changed, however, and today there are hundreds of programs, ranging from those that handle optimal locations of beverage and ice cream stands on beaches to those that deal with demographically oriented issues such as depicting the growth of population in Sweden by emphasizing three-dimensional surface maps. Now, with the proliferation of software, a computer user frequently has access to several programs that do the same thing but in different program languages.

This is not to say that the book merits little attention; rather, much of its intent has been depreciated by the plethora of available canned programs, as well as by the requirement or strong suggestion by many departments that anyone who majors in geography take at least one course in computer programming. However, for persons who for one reason or another have not availed themselves of such study or who need to brush up on subroutines or the use of loops, this book will be highly beneficial. The authors should be congratulated for avoiding the temptation to write a treatise on "all there is to know about computer programming," something best left to professional programmers. The appeal of the book derives from its simple, straightforward approach and the logical progression of sequential steps that makes it ideal for self-paced instruction. This is accomplished through a problem-solving framework

that uses examples common to geography, is devoid of complex statistical manipulation of data matrices, and at no time assumes a high level of mathematical sophistication. While reading the book one experiences a sense of well-being, a feeling that the authors have successfully led students through this learning procedure many times in the past. In other words, the contents have been adequately field tested, and necessary additions and deletions have long since been attended to. Unfortunately, the fact that some of the computer printouts are almost impossible to decipher because of faulty printing detracts from the overall quality of the book. This, however, is a purely technical matter that should be rectified by the publisher.

The authors are realists and recognize that their contribution is only one pause, a pause for breath if you like, in the rapidly accelerating computer revolution. The proliferation of innovative hardware and software continues, along with the geometrical growth of computer users, and problems that once appeared to be insurmountable have proved to be surprisingly amenable to computerization.—KENNARD W. RUMAGE

BLACK SUBURBANIZATION: Access to Improved Quality of Life or Maintenance of the Status Quo? By HAROLD M. ROSE. xiv and 288 pp.; maps, diagrs., ill., index. Ballinger Publishing Company, Cambridge, Massachusetts, 1976. \$16.00. 9¼ x 6¼ inches.

During the 1970's the myth of a monolithic, white, middle-class suburbia has been challenged by studies in several disciplines. The stereotype of residential suburbia as an urban world separately structured from the central city is no longer acceptable. It is now recognized that both possess highly heterogeneous social congregations. The major differences between them are the lower population density and the higher average income found in the suburban mosaic. As attention focuses on the internal components of suburban social space, studies of black neighborhoods pave the way toward an understanding of ethnic patterns in the outer metropolitan ring, not only because of current interest in this social group but also because black population concentrations are readily identifiable in census tabulations and in the field.

Suburbia has always housed blacks in locally segregated enclaves or "little ghettos." Many of these dispersed pockets are associated with old commuter rail corridors and originated in the nineteenth century as trackside shacktowns. They housed domestic workers near the places of their employment in homes of wealthy landowners who resided on the then rural-urban fringe. In recent decades several such isolated black colonies have endured by resisting decimation by local zoning and other exclusionary devices. Although surrounding social barriers prevent territorial expansion, internal growth has occurred through intensified residential densities. Of far greater significance in the recent suburbanization of blacks, however, is the spillover of central city ghettos into adjacent inner suburbs. Young middle-income black families in search of better housing dominate this "zone of emergence," as George Sternlieb has called it. The process is well under way in such metropolises as Washington, Cleveland, Los Angeles, and New York-Northeastern New Jersey. Nevertheless, black migration since 1960 has been quite modest in relation to the tidal wave of suburbanizing whites, and the persistence of dual housing markets ensures that limited black suburbanization does not result in progress toward racial integration. Black suburbs are just as segregated as black central city neighborhoods. White refusal to share urban residential space is all but universal, and evidence shows that suburban segregation has actually increased during the latest intercensal period.

Although a considerable literature on black suburbanization has accumulated since the early 1970's, few geographers have contributed to it. A major exception is Harold Rose, whose writings in the mid-1960's first shed light on the problems of outlying all-black towns. His later research on ghettoization processes was then applied to the suburban ring in his pioneering 1972 article, "The All Black Town: Suburban Prototype or Rural Slum?" (*in People and Politics in Urban Society* [edited by Harlan Hahn; *Urban Affairs Annual Reviews* No. 6, Sage Publications, Beverly Hills, Calif., 1972], pp. 397-431). The book reviewed here is an outgrowth and an expansion of that work which was sponsored by the Association of American Geogra-

phers "Black Towns Project." It permitted field surveys and follow-up analyses of data collected in fifteen suburban communities experiencing black population growth. Despite the modest sample size, Rose has carefully chosen his suburban case studies from every region of the country, and I am convinced of the validity of generalizing from these typical test communities. The findings of the overall study contain no surprises because the evidence is overwhelming that the growth of black suburban neighborhoods is mostly shaped by a continuation of the well-known central city ghettoization process.

Rose's documentation of the process in suburbia is arranged into seven chapters that treat the evolution of black enclaves, housing environments and markets, educational opportunities, socioeconomic and demographic characteristics of suburban blacks, home-workplace travel patterns, services and quality-of-life variations, and a policy-oriented overview. His presentation is sober and detached, undoubtedly in part because of the need to summarize a large body of occasionally inconclusive data. This task could perhaps have been better handled by the use of more tables and fewer factual descriptions in the text. The author is served even more poorly by his editors, however, in matters of organization and clarity of expression, a feature especially apparent in the rushed opening chapter, which contains material concentrated enough for at least two chapters. Uninitiated readers require a more slowly paced introduction to the important contrasts between colonized and ghettoized black suburbs. Moreover, this engagement problem is compounded by the placement of vital discursive and bibliographical footnotes at the back of the book.

Harold Rose has given us a wealth of information about his representative communities in this first full-length attempt at a comprehensive study of black suburbanization. Although his findings have not exhausted the interpretative possibilities, Rose does provide a solid empirical dimension to support his 1972 classification of black suburban settlement types. With the establishment of this typology and the identification of spatial processes responsible for the limited access of blacks to suburbia, the way is now clear to debate more forcefully the social injustices inherent in this system as well as public policies that may help counteract the negative consequences of metropolitanwide racial polarization.—PETER O. MULLER

URBAN GROWTH IN THE NONMETROPOLITAN SOUTH. By LEONARD F. WHEAT.
xvi and 171 pp.; index. Lexington Books, Lexington, Massachusetts, and Toronto, 1976.
\$16.00. 9 1/4 x 6 1/2 inches.

Even though the title of Leonard F. Wheat's latest book at first glance appears to contain a contradiction in terms, it does not. Small cities (in nonmetropolitan areas) in the American South have, in fact, experienced substantial increases in population, industry, and commerce, especially since 1960. In the 1960's urban growth in nonmetropolitan areas (cities with 5,000 to 50,000 inhabitants) in the South was almost 35 percent—the same as metropolitan growth in the region but considerably above the total regional growth rate of less than 15 percent.

The author examines rapidly growing and slowly growing nonmetropolitan cities in order to determine the causes of growth, find statistical indicators of growth potential, and use these indicators as predictors of fast or slow rates of growth. More than two hundred independent variables for 116 cities for the 1960–1970 decade were tested. The Southeast was compared with the Southwest, the latter, rather arbitrarily and oddly, including Mississippi, Arkansas, Louisiana, Oklahoma, and Texas.

The study is a massive multiple correlation-regression analysis, or rather a series of analyses—some would call it an extended fishing trip—including chi-square testing. After a brief statement of objectives, Wheat interprets the relationship between each of the numerous independent variables and each of the three dependent variables used to measure growth. The twenty-three hypotheses are evaluated under ten headings, each of which constitutes a chapter approximately ten pages long and includes a large number of tables and textual listings. These

chapters describe the effect of the following categories of independent variables on the growth of nonmetropolitan cities: population size, manufacturing, transportation, education, labor, property taxes, proximity to a metropolitan area, racial composition, urban amenities, and economic conditions.

The presentation is not easy to read, and too often meaning is lost in entangled technical terminology. In a particularly tedious example, Wheat reports that "the best highway correlations came not from HWY but from variables derived from it. Best in the Southeast was $1/\log$ HWY (0.8). This is the reciprocal of the logarithm of HWY, except that its value is constant at 0.8 ($1/\log 16$) for distances of 16 miles or more." The text also has numerous short, choppy paragraphs, often consisting of only two or three sentences. At best, the book should have been edited to remove the flavor and tone of a hurriedly written, if not hastily dictated, manuscript.

What the analysis yields, in summary form, is contained in a concluding chapter. For cities with between 5,000 and 50,000 inhabitants, population size does not affect growth. Centers with high levels of capital-intensive industry grow fast. However, cities with labor-intensive manufacturing tend to grow slowly, as do cities with little manufacturing employment. Wheat finds that "proximity to a commercial airport . . . is the best single indicator of growth potential for the South," but he does not evaluate whether the variable "airport proximity" is merely a proxy for position within the urban hierarchy or the airport itself influences locational decision making. Proximity to major metropolitan areas, Wheat discovers, is related to population growth in the Southwest but not in the Southeast. Other variables that affect growth are the presence of a college or university, interstate highways (in the Southeast), prior growth, prior net migration, and unemployment levels. A high percentage of nonwhite population is associated with slow growth. Urban amenities do not predict growth.

The study offers a large number of interesting empirical findings and statistical relationships from the 1960's, but its theoretical and conceptual content is left to the reader's speculations. Although it is apparent that Wheat had some basis for selecting his many hypotheses and his even larger number of variables (including their particular transformations), he does not indicate the conceptual foundation of the research. The reader is informed that the South was chosen as the study region because it is growing rapidly and at the same time "has a disproportionate share of the nation's distressed areas" and because the number of cities in the region was regarded as an adequate sample. All in all, the value of Wheat's research would have been enhanced substantially if his study had been anchored to an identified theoretical base and tied more firmly to other published findings. A few footnotes are provided in each chapter, but no bibliography is included. The book's lack of contribution to the theoretical dimensions of urban growth is most keenly felt when one realizes that data for the 1970's may not be relevant to Wheat's correlation coefficients from the 1960's.—JAMES O. WHEELER

MARKETING GEOGRAPHY: With Special Reference to Retailing. By ROSS L. DAVIES. xiv and 300 pp.; maps, diagrs., indexes. Retailing and Planning Associates, Corbridge, Northumberland, 1976. \$13.90. $8\frac{3}{4} \times 5\frac{3}{4}$ inches.

"Marketing Geography" is an eclectic state-of-the-art book that focuses on retail location research. Interesting comparisons between retail structure and its development in Great Britain and the United States supplement a compendium of literature now considered classic. The effectiveness of handsomely designed graphics and tabular summaries is frequently minimized, however, by the small format and porous paper that make them difficult to read.

In the introductory chapter Davies presupposes a familiarity with content, authors, and places that are presented later in the book. His reference to an American school of marketing geography is illusory. Although frequent and meaningful exchanges that produced an evolving and distinctive body of work took place between academics and practitioners in the early 1960's, the pioneers had disbanded by the mid-1970's. Some of the early leaders, spurred by the

prompting of their deans, have redirected their efforts to more traditional geographical subjects. Others have abandoned geography to become company employees or private entrepreneurs. The voluminous contributions of William Applebaum represent the legacy of a single individual who, bolstered by personal recognition and institutional affiliation, shaped an energetic and unique career; but his accomplishments are a testimonial to the man, not to the field.

Davies contends that lax planning in the United States permits a spatial excess of growth and decline, but he makes no reference to Houston, a rapidly growing, unzoned city characterized by efficient and functional land use. His statements about retail rent gradients and uniformity of base rents are incorrect. He seems unaware that stores of the same size can command different considerations based on total value of sales generated or that base rents vary depending on overage rate and threshold, credit value supplied by the lessee, term of the lease and renewal options, common area maintenance, and escalator clauses. Total occupancy charges rather than total rent are a better index because total occupancy costs include nonoptional costs such as architect-designed fixtures, signage, utilities, and center promotional charges.

Implicit in "Marketing Geography" is the assumption that retail structure is a response to central place theory. Because theoreticians do not agree on how to measure or interpret centrality, the theory disintegrates into the truism that some places are more important than others. Armchair analysts who rely heavily on census data for their studies have no means of determining whether physical expansion, consolidation, or subdivision of preexisting units has taken place. The discussion of shopping center development in the United States ignores such factors as developer financing, the secondary mortgage market, tax shelters, and antitrust regulation. A shopping center is treated as a unified entity despite the common occurrence of multiple ownerships of individual buildings (particularly department stores) and outlots.

Davies relies almost exclusively on academic and geographical journals as source documents and ignores contributions from other social sciences, opinion-survey firms, advertising agencies, and selected trade organizations. Two popular types of consumer research—telephone surveys and focus groups—are not mentioned. Garner's semantic differential technique is merely the reinvention of scales that have been used widely for many years by sociologists and others.

Like many academics, Davies has a tendency to make teleological pronouncements. Preservation of the CBD is "good," development of highway-oriented retail strips is "bad," and the lower level of provision of store facilities in minority residential areas is "deplorable." His British pedagogical style is heavy and cumbersome compared with the breezy dialogue that characterizes the writings of Americans in this field. Constant references to the "real world" are annoying, and his generalization of all adult women as "housewives" is amusing.

The purpose of the book, as stated in the concluding chapter, is to develop "more substantive and flexible theories than are currently available for guiding a future pattern of business activities and understanding the tastes and preferences of the population." Davies believes that the application of theory will "provide an evaluation of alternative courses of action available and particularly in terms of what will bring most benefit to the consumer or the community at large." Business firms are requested to sponsor such research, though concerns with profit generation, break-even levels, or return on investment are never mentioned. This absence is notable because material in most of the source documents was drawn from the experience of private American firms.

As a pragmatic handbook or introduction to professional practice, the book has many shortcomings; nevertheless, it is to be praised as a first effort to explore the subject, as a concise summary and reference work, and as an invitation to contribute to the field. Geographers' myopic dedication to developing theory should be expanded to include concern for improving practice as well.—EILEEN SCHELL

A WORLD OF SCARCITIES: Critical Issues in Public Policy. By DAVID NOVICK. x and 194 pp.; index. Halsted Press, New York and Toronto, 1976. \$19.00. 9½ x 6¼ inches.

David Novick's book adds a narrow but vitally important dimension to the current concerns about material shortages. Failures in planning, huge capital requirements, and long lead time required to expand production have already ensured that the industrialized world will face serious shortages of minerals in the next decade. The author emphasizes the length of time necessary to increase output after decisions have been made and contends that some means must be found to extend the time horizons of public policy decision making.

"Because of scarcities," Novick writes in his Foreword, "the world economies are all of them in a bad way for the moment. . . . The shortage is really in man's ideas and planning rather than the physical limits of the non-renewable resources of our globe." The first half of the book, in which this proposition is developed, includes six chapters that total only ninety-seven pages. The first chapter develops the theme of scarcity and clearly reflects the fact that it was written during the 1974-1975 recession. Novick harks back to shortages of capacity in the early 1970's and suggests that they will return even more seriously when prosperity returns. The scarcities result from governmental influence on demand without planning for supply. The next chapter emphasizes the point by calling for a "comprehensive natural resources materials policy" that will plan for reduced demand and increased supply as well as prepare for emergencies. In this chapter the issue of lead time is addressed most directly, and Novick concludes that, although some expansion of output can be achieved over the next ten years, real improvement in the quantities of resources available is possible only in 1995 or later.

Chapter 3, on scarcity of energy, adds relatively little to the many available treatments of the topic. Novick emphasizes the lack of sense of urgency that has resulted in inadequate planning and expenditures. He suggests that the industrial countries had entered a critical period regarding energy reserves before the Organization of Petroleum Exporting Countries (OPEC) was founded, and he sees a series of government authorities modeled after the Reconstruction Finance Corporation and the Manhattan Project as the only solution. In Chapter 4 he predicts that groups will attempt to form cartels in other commodities on the OPEC model, but he sees little likelihood of their success.

The last two chapters emphasize the availability of ample earth materials but the inevitability of shortages in productive capacity. Novick examines briefly some of the models that have been used to predict supply and demand and finds them totally inadequate from every standpoint—methodology, data, and definitions. At this point one begins to feel that the author could have made his message clearer if he had taken more care with definitions. If he had consistently spoken of "shortages of supply" when he addressed capacity problems and of "scarcities" when he dealt with the availability of materials in the earth, the discussion would have been easier to follow.

Despite the inadequacy of data on resources, Novick predicts future supply and demand for seven materials. The second half of the book consists of a relatively superficial "Selected Natural Resources Appendix" that contains a chapter each on aluminum, timber, zinc, copper, lead, ferroalloys, and fertilizer. The author concludes that, because of either reduced demand or adequate supplies, sufficient amounts could be made available well into the next century.

In a book in which he clearly states his primary concern with public policy, Novick seems curiously insensitive to the problems of establishing and carrying out public policy. His only prescription for achieving public acceptance of draconian measures is to develop a public sense of urgency similar to that felt in wartime. The present administration would, I suspect, like more detailed guidance on how to achieve that end. Novick does an excellent job of pointing out the lead time necessary to accumulate the capital, the technology, the labor, and the facilities necessary to increase our output of resources. However, he seems to underestimate grossly two other types of lead time involved: time required in our system to reach a political decision; and the delay caused by opponents of any program who use environmental and legal pretexts to

inhibit the beginnings of the technical solutions that he proposes. Such additional lead time adds urgency to his message and should have been addressed directly in a book on public policy.

After laboring to create a sense of crisis, Novick's proffered solution is vague and unsubstantial: "We favor something like the French planning." He does not discuss the merits of this type of indicative planning, nor does he examine its successes and failures in France. In the one area for which he presents detailed suggestions, the energy crisis, his programs go far beyond anything French planners would recognize as akin to their techniques.

The utility of this presentation does not depend on one's general attitudes toward growth. Novick is obviously an enthusiast for continued economic growth, but his message must be taken to heart even by advocates of no-growth. His demonstration that many shortages are inevitable results of past policies and not of growth is too little understood. Greater awareness of the situation might reduce the seemingly blind opposition to the building of additional productive facilities.

If geographers are sincere about wanting to answer "real-world" questions, Novick's book should inspire a good deal of research. He has spent decades studying problems of material supply and here shares perspectives gained from his experience. Although he has highlighted a critical problem, he has left it to others to investigate the spatial dimensions of scarcities. Only time, however, will tell whether his prophecy that "in terms of the next ten years, we have to swallow a really bitter pill—reducing our standard of living," is accurate.—HOWARD G. ROEPKE

TROPICAL CLIMATOLOGY: An Introduction to the Climates of the Low Latitudes. By S. NIEUWOLT. x and 207 pp.; maps, diagrs., bibliogr., indexes. John Wiley & Sons, New York, 1977. \$16.50. 9 1/4 x 6 1/4 inches.

The world's tropical areas have long been assumed to experience the least complex of the earth's climates. Research in recent decades, however, has shown that simplistic explanations are quite inadequate and that tropical climatology is a research area in which much work remains to be undertaken. Unfortunately, many introductory textbooks on climate retain the simplistic approach or gloss over the intricacies involved. Most instructors will therefore be happy to see an introductory textbook that deals specifically with tropical climates. Just how well Nieuwolt's volume meets the demand will vary, for the book has both strengths and weaknesses. These occur, at least in part, simply because the volume is introductory, making it necessary for the author to be selective in the material he presents and arbitrary about the level at which it is treated.

The primary goal of the book is to provide geographical climatologists with a non-quantitative introduction, and here Nieuwolt succeeds. It is refreshing to come across a somewhat specialized textbook that uses the word "introduction" in the subtitle and then to find that it really does contain introductory matter. Furthermore, the author is careful to deal with material from a climatological viewpoint rather than a meteorological viewpoint. For example, he carefully substantiates the treatment of tropical disturbances as climatically significant. How well the book will be received by its other intended readers—"economists, planners, agriculturists and engineers from the mid-latitudes, who come to the tropics in connection with [these aid] programmes"—is difficult to ascertain.

To cover his topic adequately Nieuwolt uses a somewhat traditional approach. The material is organized into ten chapters. An introductory chapter sets the scene by defining tropical areas. In essence, Nieuwolt follows Köppen and uses the 18°C. sea level isotherm as the most expedient climatic boundary. Two chapters then treat the characteristics of radiation and temperature. The author provides a good blend of specific details on tropical lands, general coverage, and basic principles. Although his approach is useful, it does lead to some repetition, particularly in relation to conditions in tropical highlands. The general circulation of the

tropics, together with its variations and disturbances, is dealt with in three chapters. Coverage of the dynamic aspects of tropical climatology is rather brief, owing to the complete absence of mathematical and physical analysis.

Chapters 7 and 8 provide one on the strengths of the book and offer many insights into moisture and precipitation, two important sectors of tropical climatology. These are the subfields in which Nieuwolt has made most of his research contributions, and the content reflects his intimate knowledge of the problems and methodologies involved. He goes beyond a simple description of mean annual totals and provides a meaningful discussion of the variability, seasonality, and frequency of rainfall. References in these two chapters are much more comprehensive and up-to-date than those in other sections.

The reviewer of an introductory textbook inevitably sees what is not included rather than what is. In other words, my reaction to the two final chapters, one on regional climatic patterns and the other on applied tropical climatology, is rather negative. These sections should have been problem oriented, not descriptive, in my opinion. In dealing with regional climates it would have proved interesting to discuss recent droughts and to relate them to the processes covered in earlier chapters. The section on applied tropical climatology does provide brief accounts of climate in relation to agriculture, soils, and physiological response, but they are dealt with in a nonpractical way. No mention is made of such fascinating topics as man-induced climatic change or loss of agricultural land through improper knowledge of micro-climates.

On the whole Nieuwolt's book is easy to read; and although the numerous diagrams are not overly exciting, they are useful. A few errors mar the volume, but most of them are minor. One description that might be confusing is the statement in a discussion of the water needs of plants that actual evapotranspiration can be greater than potential evapotranspiration.

Nieuwolt, currently a professor of geography at Kenya's Kenyatta University, has considerable expertise in tropical climatology. If he had shared more of his personal experience with the climates that he describes, this useful book would have been a truly outstanding contribution for those who are exploring the intricacies of tropical climatology for the first time.—JOHN E. OLIVER

DEMOGRAPHIC DEVELOPMENTS IN EASTERN EUROPE. Edited by LESZEK KOŚCINSKI. xx and 348 pp.; maps, diagrs., index. Praeger Publishers, New York and London, 1977. \$25.00. 9 1/4 x 6 1/4 inches.

"Demographic Developments in Eastern Europe," the last in a series of eight books that deal with Slavic studies, is a collection of papers on various aspects of the demography of the Soviet Union as well as of Eastern Europe. The papers were originally presented at conferences held in 1974: the First International Slavic Conference at Banff, Canada; and a conference on Russian and Soviet demography at Princeton, New Jersey. The book contains fourteen essays and an introduction by the editor.

The aim of the book is not very focused, as the use of such broad terminology as "demographic developments" in the title suggests. Its apparent goal is to "fill the gap" involving the "relative underrepresentation of studies on the population of the Soviet Union and East-Central Europe." The editor admits that the book "does not offer a comprehensive comparative treatment of all aspects of population in all of the countries within the region." Consequently it suffers from a lack of both comprehensiveness and balance. For example, although the Soviet and the Eastern European parts are covered in approximately the same number of essays, the regional scope within Eastern Europe varies greatly, with individual articles devoted to Bulgaria, Poland, Hungary, Yugoslavia, and even the small western half of Slovenia in Yugoslavia but none specifically on Czechoslovakia, Romania, East Germany, or Albania. The temporal range, too, is somewhat imbalanced. Most of the essays deal with demographic developments in the twentieth century and are often quite up-to-date. Therefore,

the essay on Russian population and history primarily for the eighteenth and nineteenth centuries seems to be a little out of place. Individual articles survey sources of demographic data for the Soviet Union and for East-Central Europe, but the balance is again upset by the fact that although an article that surveys recent demographic research on the Soviet Union is included, no comparable article exists for Eastern Europe. Overall, the book appears to be a collection of somewhat unconnected articles, with no integrating format and only a one-paragraph survey of topics and chapters.

Individually, the articles in the book are generally worthwhile contributions to the study of Soviet and Eastern European demography. Two of the essays deal primarily with fertility in both the Soviet Union and Eastern Europe, one with the Soviet Union and the world population crisis, and three with overall population trends in individual areas. Of the five essays on migration, three focus on Eastern Europe, one on international migrations involving both Eastern Europe and the Soviet Union, and one on Soviet internal migration. The appreciable number of articles that deal with migration and other geographical aspects of population reflects the fact that more than half of the contributors are geographers. All in all, despite some shortcomings, this book is a useful and welcome addition to the fields of Soviet and Eastern European demography and geography.—RICHARD H. ROWLAND

CONTEMPORARY AFRICA: Geography and Change. Edited by C. GREGORY KNIGHT and JAMES L. NEWMAN. xiv and 546 pp.; maps, diags., ill., bibliogr., indexes. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1976. \$14.95. 9¼ x 6 inches.

AFRICAN SURVEY. By ALAN C. G. BEST and HARM J. DE BLIJ. xi and 626 pp.; maps, diags., ill., bibliogr., indexes. John Wiley and Sons, New York, Santa Barbara, California, London, and elsewhere, 1977. \$17.95. 10¼ x 7 inches.

Bourgeois geographers writing on Africa share a common set of assumptions, world views, and solutions regarding the essential nature and direction of the geographical transformation of the contemporary world. Their geographies presuppose, among other things, a modernizing world in which non-Western societies are adopting and adapting Western models including "naturally given" spatial units of analysis—countries and continents—and a developmental process that occurs within autonomous entities. Along with other social scientists, geographers have invented modernization, state and continental regions, and development. The result is that studies of Africa by bourgeois geographers display remarkable similarities in assumptions, identification of problems, description, and mode of analysis. Such deep-seated similarities overwhelm in significance the obvious dissimilarities in approach—topical versus regional or modern versus traditional—and in authorship—edited collections versus dual collaborations—that characterize the books under review.

In "Contemporary Africa: Geography and Change" Knight and Newman present a conceptually organized volume of essays that stress sociocultural motivations and dynamics, landscapes as social resource bases, external connections, developmentally based institutions, systems and spatial organization, and problems and potentials for change, all necessarily from a generic rather than an exotic viewpoint. In order to make the volume something more than the loosely disguised, individualistic chaos of most edited works, Knight and Newman attempt to order the essays by means of a thematic introduction and brief preambles to sections. The thirty-two papers by twenty-eight authors are grouped into sections entitled "The Persistence of the Past," "Parameters of Change," "Rural Change," "Urban Change," "Rural-Urban Systems," "Modernization," and "Africa in the World." Unfortunately, they are only moderately successful in their difficult task, partly because the collaborators do not always adhere to a common geographical scale, even though "black Africa" is the stated focus of the volume. Sometimes the scale is larger and sometimes smaller, resulting in neither a mosaic nor a totality. The diverse interests, experiences, understandings, and aims of the multinational authorship lead to astigmatism, myopia, or other unbalanced or fragmented groupings of papers. The extreme example is the first section, "The Persistence of the Past," which contains

only three papers, one on the peoples of Africa and two on colonial officials and colonialism. Individually, however, many of the papers are interesting, innovative, and competent; I would just mention Ben Wisner's "Health and the Geography of Wholeness" and Len Berry's "Dynamics and Processes of Rural Change." The book is an ambitious effort, and I suspect, my criticisms notwithstanding, that the profession will receive it enthusiastically.

In "African Survey" Best and de Blij present a thematic regional geography that is explicitly intended to deal geographically with developmental issues and prospects. A second and somewhat contradictory objective, "to place Africa's changing cultural landscapes in geographical context," is neither conceptually nor substantively treated. After perfunctory sections on the physical environment, political and population themes for the continent as a whole are described. Thereafter the treatment is thematic, usually either politically geographical or what they call "sociocultural," on a country or cluster-of-countries basis. The twenty-eight regional chapters are handled idiosyncratically because the selection by the authors of the dominant themes for each one is essentially arbitrary. Why should "development" be handled geopolitically for the Sudan but socioculturally for Somalia? A considerable part of the problem lies in the absence of any extensive discussion of what is meant by "development," even though by the time one finishes the book it is not too difficult to ascertain the underlying assumptions of Best and de Blij regarding that and related concepts, as well as those concerning the appropriate units of analysis. Again, as a text "African Survey" will most probably find an extensive market.

These are works of devoted and well-intentioned scholarship and liberal social action, but they have perhaps unwittingly designed an illusory world for Africa. We live not in a modernizing world but in a capitalist one. The drive for profit and capital accumulation, not the need to achieve, is the force that propels the world to change. The problem for the poor, weak classes and countries is not how to communicate within the world but how to overthrow it. No external models exist for the future of any African country.

The transformation of African societies is being worked out in the internal relationships to be found within the capitalist world economy: of periphery to core, of peasant and proletarian to bourgeois, of resistant cultures to hegemonic culture, of institutionally oppressed racial and ethnic strata to dominant strata demanding universalistic individualism, of economically underdeveloped to exploitative overdeveloped. Geographers of Africa can measure these, but we have not been doing so, as these works attest.—GERRY A. HALE

IMMIGRANTS IN THE OZARKS: A Study in Ethnic Geography. By RUSSEL L. GERLACH. xiii and 206 pp.; maps, ills., bibliogr., index. University of Missouri Press, Columbia and London, 1976. \$15.00. 9½ x 6½ inches.

Have ethnic migrants left their mark on the landscape of the Missouri Ozarks? Have they retained a sense of ethnic identity? How different are they from "Old Stock Americans," a phrase coined by the author for the English-speaking folk with Appalachian backgrounds and a penchant for short-distance westward migration? Gerlach, who might be termed a third-generation disciple of Carl Sauer, deals with these and related questions. By presenting an analysis of such traits as language, house types, churches and church membership, field patterns, agricultural practices, festivals, and settlement forms, this scholarly and readable work will, I hope, encourage studies of other Ozark areas.

In the rural Missouri Ozarks more than 10 percent of the population appears to be ethnic, and at least 60 percent of these are German. Other ethnic groups studied in detail are the French Waldensians, Italians, Swiss, Swedes, Poles, and the French at Old Mines, a barite mining district in Washington County. The Amish and the Mennonites, recent migratory groups, are also considered. A valuable Appendix to Gerlach's text lists the origins of both Old Stock Americans and other ethnic populations.

Massive fieldwork and in-depth studies of six areas add firsthand facts to Gerlach's examination of published and unpublished materials. He uses photographs to support his text; most

of these would have been more effective had the foregrounds been cropped. His mapping of many types of data reaffirms the importance of local maps in this kind of geographical study. A map showing the relationship between railroads and ethnic settlements is particularly noteworthy. On the matter of maps, inclusion of a base map with county names would have helped readers who are not familiar with the area.

Instead of the melting-pot concept Gerlach depicts a landscape that is a human patchwork. Some pieces of the patchwork are Old Stock American, some are still Old World, and others have become something unique to the Ozarks as they adjusted to a poor resource base. Gerlach's depiction would have been stronger had he been more concerned with the physical environment. Pioneers used water from the perennial streams and springs. They coped with floods after heavy rains in a region of more than forty inches of rainfall a year. Narrow "hollers" intensified the danger of floods, and the severely dissected uplands limited access and movement. Cherty soils and erosion meant hard work with little return. Such a backdrop needs greater emphasis in what is otherwise a significant contribution to the understanding of a region that today is better known to tourists going fishing than to scholars attempting, in Sauer's words, to see "meaningful associations of land and life."—E. JOAN WILSON MILLER

DOMESDAY ENGLAND. By H. C. DARBY. xiv and 416 pp.; maps, index. Cambridge University Press, Cambridge, London, and elsewhere, 1977. \$45.00. 9½ x 6½ inches.

For more than forty years H. C. Darby has worked as teacher, researcher, and administrator. His accomplishments in these areas were honored by the Association of American Geographers in 1977. The public citation recorded his use of primary documentary materials as a source of geographical data, his skill in the study of the geographical past of England, and his ability to provide methodological inspiration to an international audience of scholars. "Domesday England," published just as Darby retired from his academic chair at the University of Cambridge, is an example of what the citation extolled and is also the capstone volume in a lifelong project that has dealt with both primary source materials and the geography of medieval England.

Since 1952, Darby and his collaborators have published a series of volumes that use the Norman Domesday Book as the basis for a physical and cultural description of the geography of England in the eleventh century. Since most of us are captives of the usual academic rhythm of bits-and-pieces publication, the enduring singleness of purpose and unfolding accumulation of expertise shown by Darby and his associates in attacking an indurate source of raw data, their capacity to overcome challenges of presentation, and their ability to plan, schedule, and carry out the mammoth project with a fineness of detail and an appropriateness of timing excite profound admiration.

By means of an extremely well organized index system, Darby has used the data contained in the five published regional volumes to produce, in "Domesday England," a descriptive geography of the realm as it was recorded in the Norman inquest of the last quarter of the eleventh century. A chapter on the background and techniques of this great survey provides a necessary introduction. Thereafter follow nine chapters concerned with such topics as population, the extent and nature of arable land, types and distributions of manufactures, and the spatial pattern of urban places. Economic geography is presented in chapters on rural resources including grazing lands and forests, and the Norman assessments are discussed in both their technical and distributional dimensions. In addition, a topic related to economic failure (land devastation and abandonment) is accorded chapter status. Some geopolitical problems of the Norman era are discussed in a chapter that is a detailed case study of the troublesome Welsh marchlands. Medieval geographical wine has been poured into modern systematic bottles, and as a summary of the earlier regional volumes, Darby's efforts succeed admirably.

The technical apparatus of this volume is extensive and provides us necessary overviews. The first twenty appendixes start with a concise statistical table in which the numbers of settlements, plowlands, and plow teams, the rural population totals, and the number of

boroughs of the Domesday counties are summarized. In addition, marshes, forests, and vineyards are tabulated, along with lists of markets and mints, and the 112 boroughs of Domesday time are described in statistical terms. The book is illustrated with 111 maps expertly drawn by Darby's longtime cartographic associate, G. R. Versey. The clear and uncluttered design characteristic of these maps helps to convey a great deal of concise information. Maps depict post-1066 rural depredations resulting from wars and raids, illustrate the extent of Domesday woodland, and reconstruct the "urban fields" of southeastern England as these may be assumed for 1086.

The penultimate appendix lists the contents of and contributors to the five regional volumes in Darby's Domesday geography of England, which were published within the brief span of fifteen years and were augmented in 1975 by a gazetteer. In attempting to sum up the accomplishments of the author's lifelong study of Domesday England, we may wish to ask that what it was like to undertake and carry out such a comprehensive and demanding task. Darby's reflections on these points are contained in an appendix, so we are able to learn more about the author himself and about the way in which the work was carried forward. Darby uses six points raised, over the years, in reviews of the Domesday England volumes as a framework for his retrospective and evaluative comments. Fortunately for the students of medieval Britain, Darby's energies proved equal to the prolonged task, and we can today profit from his balanced account of the anxieties and the triumphs of this undertaking.

What is next for Domesday research now that Darby's masterly contribution has been completed? Further interpretative work with the Darby series would seem to be one profitable line, and it would provide a training ground for aspiring specialists in this corpus of geographical data. Putting the Domesday Book into a computer and assessing in statistical fashion the riches of this source in another possibility that is already being attempted. Beyond the manipulation of the data and the distributions that are revealed, there will remain the continuing study of the nature and purpose of this great collection of information, studies sufficiently intriguing to employ interested scholars well beyond the approaching nonacentennial of the Domesday Book.—ROBERT M. NEWCOMB

THE FOOD CRISIS IN PREHISTORY: Overpopulation and the Origins of Agriculture. By MARK NATHAN COHEN. x and 341 pp.; bibliogr., index. Yale University Press, New Haven, Connecticut, and London, 1977. \$15.00. 8½ x 5¾ inches.

Cohen candidly states his belief that agriculture originated as an answer to overpopulation, and his book is more a defense of the thesis than a comprehensive or balanced review of world prehistory. It is written in a lively manner, but the reader must keep his critical faculties sharpened.

Cohen is struck by the fact that after a few million years of existence most of mankind took up agriculture in a short 2,000-year period beginning about 10,000 years ago. By then, he argues, human beings had occupied all of the world and had begun to press their resource base. Mankind had no place to run, not to the desert, to the mountains, to the Arctic, or even to the New World. A new adaptive strategy had to be found, and so man took up agriculture.

Because mankind knew that plants grew from seeds and tubers, Cohen assumes that man always knew of agriculture and that all that was needed was an impulse to apply the knowledge. The impulse was supplied by population pressure, virtually equally everywhere and virtually simultaneously. In concept, the change was easy, for it involved a continuum of old practices slightly modified.

Cohen introduces a population flux concept to explain the excessively long time, more than a million years, it took to reach population saturation. Movement of people among bands of foragers equalized population irregularities over vast regions, even worldwide, for nearly a million years. An interesting and lengthy set of measures of environmental population stresses are given. When some of these traits appear in the archaeological record, population pressure is

assumed. The world is then surveyed for these telltale signs. Cohen finds that as man expanded into ever-wider areas and as big game animals became extinct, less desirable foods were used. The record of food processing becomes ever clearer, and then agriculture appears.

My disagreements with Cohen are legion in detail but sift down to a few items in principle. The simultaneous worldwide attainment of sufficient population pressure to cause plural agricultural origins is a novel idea, but it seems most unlikely that over the entire world a population crisis would arise at virtually the same moment and lead to the origin of agriculture. Studies of foragers have shown that famine occurs about once every twenty-five years, and this is the probable pattern for a million years or so. If famine is a measure of overpopulation, and if overpopulation is a sufficient cause to lead to agriculture, then we should see many origins of agriculture, and far earlier than we do.

The earliest domestic plant in America and astonishingly early in Asia is *Lagenaria*, the dipper or bottle gourd. In Mexico it is accompanied by *Setaria*, a grass that also appears in the earliest Chinese agriculture. In Mexico cucurbits and beans, the look-alikes of the Asiatic melons and beans, are next to appear as domestics, and maize appears belatedly. The situation suggests a combination of direct and stimulus diffusion.

It is astonishing to read an anthropologist equating knowledge that "plants come from seeds" with "knowing agriculture." As well claim that living in caves is the same as knowing the true arch. The startling thing about agriculture is that it did not appear everywhere despite the orientation of all mankind to plants for millions of years. At most there were eight primary centers of origin. Many would reduce the figure to four, some to two, and I have argued that it just might be only one; but admittedly the single center is as venturesome as Cohen's thesis.

Cohen's bibliography is enormous, but it has omissions. Lowell Bean's group in California documents a far greater stress in the forager's life than any of Cohen's authorities. Similarly, Homer Aschmann's classic study of forager population density in the desert of central Baja California indicates an error of at least tenfold in the authorities on Lower Paleolithic population that Cohen cites.

Cohen assumes repeated independent invention owing to environmental needs or pressures, an opinion that is rampant environmental determinism, even if it is clothed as work strategy in response to stress. There is discussion throughout the book of grinding slabs (*manos* and *metates*). Cohen assumes them to be late (post 30,000 B.P.) and to be well reported, but they are not. They are poorly reported but are widely represented in the Middle Stone Age of Africa, once thought to date back to 30,000 B.P. but now dated back to 180,000 B.P.

As might be expected, my view of Cohen's review of American archaeology is even more critical. To state some contradictory evidence rather didactically, the earliest date for man in America now suggested is 120,000 at San Diego. Cohen prefers 12,000. The first men in America were Lower Paleolithic in level, not skilled hunters. Vast, not little, amounts of evidence of these men exist. *Manos* and *metates* are very early, 85,000 years or more, not 10,000. The Harris site, a San Dieguito site near San Diego, lacked *metates* because it was a quarry where *metates* should not be expected. More recent excavations of other San Dieguito campsites do reveal *metates*. Shellfish utilization is not late, for human skeletons from shell middens at La Jolla date to 50,000 years and probably are not the earliest. The use of such poorly defined terms as San Dieguito in Southern California raises questions about Cohen's surveys of other areas.

Cohen views Mexico as a case "reasonably unclouded by controversies about diffusion of crops." Alas, *Lagenaria* alone would becloud the issue. Cohen has a very selective memory. Tcosinte is dwelt upon as hard to process, but at the conference on agricultural origins in which Cohen and I both participated George W. Beadle demonstrated that it is easily prepared by popping and that popping of grains was known to the most primitive gatherers of America.

Cohen warns his readers that he offers a thesis, not a balanced view. It is a challenging thesis, and he defends it well. However, one should read with caution and be prepared to winnow the chaff from the grain.—GEORGE F. CARTER

THE LAY OF THE LAND: Metaphor as Experience and History in American Life and Letters. By ANNETTE KOLONNY. xii and 185 pp.; bibliogr., index. University of North Carolina Press, Chapel Hill, 1975. \$8.95. 9½ x 6¼ inches.

The title of this book will remind geographers of "The Making of the Broads" (J. M. Lambert and others; *Royal Geogr. Soc. Research Memoir No. 3*, 1960). But Kolodny's pun is deliberate. In her view American attitudes toward, and treatment of, environment have been shaped by a pervasive metaphor: the land as woman. The landscapes of other countries, to be sure, are often viewed as feminine; but persistent images of an America "experienced as at once Mother and Virgin, with all the confusions possible in between," engendered a conflict still unresolved by American males. Walter Raleigh's Guiana, with "maydenhead never sackt, turned, nor wrought," and Thomas Morton's New England, "a faire virgin, longing to be sped, / And meete her lover in a Nuptiall bed," seem incongruous alongside John Hammond's Maryland, "twice . . . deflowed by her own Inhabitants, stript, shorne, and made deformed."

Kolodny's characterization of American ambivalence conveys both the focus and the flavor of her book. "Implicit in the metaphor of the land-as-woman was both the regressive pull of maternal containment and the seductive invitation to sexual assertion: if the Mother demands passivity, and threatens regression, the Virgin apparently invites sexual assertion and awaits impregnation. . . . The American literary imagination found itself forced to choose between a landscape that at once promised total gratification in return for passive and even filial responses and yet, also, apparently tempted, even invited, the more active responses of impregnation, alteration, and possession." Americans were caught between passive admiration for the beauties of nature and the need to turn nature to use. "The sense of guilt aroused by the conflict between the impulse to see nature as bountiful and the desire to dominate it . . . is still a central concern within the American psyche."

These themes Kolodny traces through the work of Philip Freneau, Hector St. John de Crèvecoeur, John James Audubon, James Fenimore Cooper, William Gilmore Simms, and William Faulkner—all males. Their protagonists tend to reject their own sexuality, like Cooper's Natty Bumppo, who turns his back on matrimony to live with Mother Earth. "Our continuing fascination with the lone male in the wilderness, and our literary heritage of essentially adolescent, presexual pastoral heroes, suggest that we have yet to come up with a satisfying model for mature masculinity."

As long as the frontier endured, virgin lands held out sexual as well as other promises. "The initial discovery of the continent, combined with its apparently limitless terrain, provided Americans with . . . almost three hundred years during which to believe that infantile fantasies were about to become adult realities." But the closing of the frontier left Americans bereft of landscapes on which to project their pastoral paradise, and "the frustration of the pastoral impulse was finally expressed through anger—anger at the land that had seemed to promise and then defeat men's longings."

Kolodny's "growing distress at what we have done to our continent" was the initial impetus for her research. Her suggested solution is based on Benjamin Lee Whorf's view that words shape acts: we can reform environmental behavior by developing a more mature language of environmental interaction. "Our survival may depend on our ability to escape the verbal patterns that have bound us either to fear of being engulfed by our physical environment, or to the opposite attitude of aggression and conquest." To stop "turning 'America the Beautiful' into *America the Raped*, . . . we need a radically new symbolic mode for relating to 'the fairest, frutefullest, and pleasauntest [land] of all the worlde.'"

These hypotheses, alike audacious and simplistic, depend largely on assumptions borrowed from psychohistory and on a heavy-handed application of Freudian concepts. They are unconvincing both because Kolodny's interpretation of sexual metaphors is so literal and ahistorical—to consider Jefferson's farmer "erotic" simply because *Notes on Virginia* envisages the "immensity of land courting the industry of the husbandman" strains credulity—and

because such metaphors are too common to account for an American environmental personality, as distinct, say, from that of other newly settled lands.

Even where psychoanalytic jargon does not burden the author's style, lack of clarity often bewilders: "Freneau, of course, was only the first of many who failed to locate an appropriate and enduring pastoral landscape in the New World; but while later dreamers came up against the brick walls of politics or industrial progress, Freneau, in the eighteenth century, was also forced to joust with language." Some infelicities make it hard to take Kolodny's propositions seriously: "But such speculations are only the beginning: the more we understand how we use language and, conversely, how (in some sense) language uses us, the stronger the possibility becomes that we may actually begin to choose more beneficial patterns for labeling and experiencing that mysterious realm of phenomena outside ourselves and, hopefully, with that, better our chances for survival amid phenomena that, after all, we know only through the intercession of our brain's encodings." Can anyone truly concerned about the importance of words write like that?

These defects notwithstanding, "The Lay of the Land" is an exciting and important book. Our characteristic attitudes toward land and landscape, environment and resources, do make sense in Kolodny's framework. The American version of the pastoral does invoke the notion of virgin innocence. Americans do feel intense guilt for the rape of their land. Our retreat to nature is an escape from the ties of society, family, maturity: "Infantile and presexual as he is, Natty Bumppo remains, in many ways, an embodiment of The American Dream. A pastoral landscape still seems to beckon to us, calling us into state parks and our children to summer camps, urging us to withdraw from the current and go back to an initial moment of perfect peace, absolute harmony, and freedom from want, within a feminine and wholly gratifying natural world."

Kolodny has drawn attention to a little explored, if not unrecognized facet of American relationships with land. Those interested in pursuing her hypothesis further will want to cast a wider net, to quarry the social and literary archives of the frontier, and to examine the environmental attitudes of those Americans Kolodny chose deliberately to exclude from scrutiny: women themselves.—DAVID LOWENTHAL

ABSTRACTS OF ARTICLES

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Windbreaks in the Lower Rhone Valley

DANIEL W. GADE

With the spread of irrigated horticulture in the mid-nineteenth century, hedgerows transformed the visual character of much of lowland Provence. Quickset alignments of Mediterranean cypress and white poplar and dead hedges of arundo protect market gardens and orchards from the mistral. Without windbreak protection, this northerly wind would damage fruits and vegetables, promote evapotranspiration, and increase the possibility of advection frost. Crop maturity is hastened on the lee side of the hedge, which has higher temperatures and receives more sunshine. Synthetic shelters permit even earlier crop maturation and are used in conjunction with hedgerows. Height and penetrability of the hedge, land use, and property boundaries influence positioning. Changing technology, economic displacement, land use infringement, tree diseases, or new perceptions could, however, modify this distinctive cultural landscape.

Easter Island: The Scottish Connection

J. DOUGLAS PORTEOUS

Between 1868 and 1952 Scottish entrepreneurs transformed Easter Island from a subsistence economy to a commercial wool-producing ranch. In doing so, they created in eastern Polynesia the landscape, economy, and sociopolitical system of a nineteenth-century Scottish estate. The sheep-related "improvements" that had so radically transformed Scotland after 1745 were introduced to Easter Island by ranch managers of Scottish ancestry. Population clearance and resettlement occurred. Ancient customs and the authority of the former island chiefs were replaced by company authority and a company-organized economic cycle. A complete Hebridean polity emerged, with the company as absentee laird, the resident manager as factor, and the Polynesians as crofters. The paddocks, shelterbelts, and dry stone walls of the Europeans' angular, carpentered world were superimposed on a traditional landscape that had previously been characterized by rounded forms.

Environmental Risk Factors of California Encephalitis in Man

GERALD F. PYLE and ROBERT M. COOK

Researchers have identified such environmental factors as poor drainage and mixed mesophytic forest habitats as risk elements in the diffusion of arthropod-borne encephalitis. An examination of these and other environmental risk factors contributing to endemic California encephalitis in Ohio also suggests the complex effects of Pleistocene glaciation on drainage patterns and hence mosquito proliferation. Cycles of California encephalitis in endemic parts of Ohio are correlated with fluctuations of rainfall. The diffusion of California encephalitis is also shown to be logistic in four different locations. The study findings suggest that a more detailed analysis of California encephalitis in the Great Lakes region is in order.

The Postwar Mobility Transition in Eastern Europe

ROLAND J. FUCHS and GEORGE J. DEMKO

Zelinsky's mobility transition hypothesis is applied to postwar changes in mobility in Eastern Europe, where commuting has come to substitute for rural-urban migration in converting a rural work force to urban industrial employment. The transition in Eastern Europe has been affected by government policies regarding industrialization, housing, urbanization, and mobility. The growing commuting population has raised problems of labor productivity, physical planning, and transportation. Since commuters are largely young and unskilled male workers, serious social problems have also arisen. The causes, characteristics, and consequences of the mobility transition in Eastern Europe are evidently the result of culture-specific processes that raise questions about the universal applicability and utility of the mobility transition model.

Planning Leningrad

DENIS J. B. SHAW

A new general plan for the city of Leningrad was promulgated in July, 1966, underlining the Soviet government's recognition of the need to tackle pressing urban problems and to move toward socialist goals. Since that time spectacular progress has been made, especially in the housing program, although much remains to be done. Other enduring problems, such as the backlog in servicing and cultural provision and in public transportation services, remain unsolved. Leningrad to date seems to have eluded many of the characteristic difficulties of Western urbanism, but others, such as continuing in-migration and urban sprawl, are apparently not easily controlled even in a planned economy. Moreover, there is evidence that some Soviet planners are questioning whether large-scale planning is in fact producing the type of environment in which people want to live.

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CONTINUITY AND CHANGE IN HISTORIC CITIES: BATH, CHESTER, AND NORWICH

LARRY R. FORD

MANY scholars, including geographers, express an interest in the history of urban form and attempt, from time to time, to classify cities as preindustrial or modern, as ancient, medieval, Baroque, or industrial, or as Georgian, Victorian, or Edwardian. Once cities have been classified, they are left to lie forever in the niche of their origin or era of greatest importance. Discussions of Victorian Amsterdam or Georgian Leeds are rare indeed. We seek pure types to illustrate such topics as changing aesthetic ideals and varying sociospatial organization. The effects of time and change on these pure types are rarely considered. They should be.

If we are to study the past and learn from it, we need to know how well cities have been able to adapt and to accept change as well as what they were like during their respective "Golden Eras." Some types of urban form may facilitate change and encourage the continuing importance of a place, whereas others may be inflexible and thus hasten the decline of an urban center. Cultural attitudes toward change are important. If a city seeks to keep its entire heritage intact (as, say, a replica of the cosmos), change is impossible and obsolescence is inevitable. On the other hand, if a city erases its past too quickly it may lose touch with its heritage and become chaotic, ambiguous, and "placeless." It can be argued that continuity and change are both desirable, so that the comfort of the past may anchor the excitement of the future. Kevin Lynch maintains that "the best environment is one in which there are both new stimuli and familiar reassurances, the chance to explore and the ability to return."¹ He feels that although obsolete environments should not be preserved, massive, irreversible change and excessive rates of change should be prevented. To develop enlightened "change management" policies, in the long run we must develop not only preservation techniques and legislation but a better understanding of the relationship between urban form and capacity for change.

CHANGE MANAGEMENT

The year 1975 was Architectural Heritage Year in Europe, and special projects and conferences on the topic were numerous. Unfortunately, much of that heritage is in trouble. It may be that building replicas of historic cities (as in Warsaw, Dresden, or Leningrad) is easier than preserving real ones. Some of Europe's historic cities are

¹ Kevin Lynch: *What Time is This Place?* (M.I.T. Press, Cambridge, Mass., 1972), p. 204.

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experiencing overdevelopment of a conflicting character and scale. Gloucester, where more than two hundred listed buildings have been torn down to make room for chain stores, parking lots, and slab-style council housing, is a good example. Other cities are being strangled by overprotection and stagnation. Venice, for example, though it seems lively in the summer, may be on the verge of becoming a rather damp ghost town in winter. The population of island Venice dropped from 191,199 in 1951 to 127,819 in 1969 and is still declining. Almost a third of the people who live in Venice want to move from their present lodgings, and almost half of the city's 39,000 dwellings need drastic renovation and repair in order to be habitable.² The problem is "change management." How can a city be modernized and made livable without destroying its character and sense of place?³

Historic architecture may be necessary to make a place a place, as the Poles realized when they rebuilt Old Warsaw, but it may also be desirable to encourage some gradual change. Although "creative infill" can add economic vitality to a city without destroying its scale or character, massive urban renewal can be frightening and counterproductive (as many American cities have learned the hard way). The English seem to be better at managing gradual, sympathetic change than most. American and continental planners are visiting England in increasing numbers to learn its techniques for permitting the proper dosage of growth and change in historic settings.

THE ENGLISH LANDSCAPE

Geographers have described England as a country in which the landscape is both appreciated and protected. David Lowenthal and Hugh C. Prince, for example, saw an England protected by such landscape tastes as facadism, antiquarianism, and love of the picturesque.⁴ England, albeit mostly rural England, was a place where things fit together, where the new and the old quickly weathered into a mellow, mutually supportive scene. Recently, however, problems have arisen.

During the 1960's England experienced rapid, massive, and irreversible change in many areas. Motorways were built through meadows and historic towns; and power plants, shopping centers, office towers, and parking lots became ubiquitous. Many view this rapid change with a great deal of alarm. Books such as "Goodbye Britain," "The Rape of Britain," "Derelict Britain," and "The Sack of Bath," as well as a great many publications by the National Trust and Department of the Environment, have chronicled examples of cataclysmic change.⁵ One of the highlights in the continuing saga of massive change came in the spring of 1974, when an entire fishing village near Aberdeen was destroyed to make way for an oil refinery. Fortunately, as the pressures

² "The Conservation of Cities" (UNESCO; Croom Helm, London, 1975), p. 161.

³ See, for example, "New Life for Historic Areas" (Dept. of the Environment, London, 1972); "Chester: A Study in Conservation" (Donald Insall and Associates, London, 1968); *Arch. Rev.*, Vol. 158, 1975, pp. 258-317 (special issue on architectural preservation in Great Britain); Wayland Kennet: Preservation (Temple Smith, London, 1972); Gerald Burke: Townscapes (Pelican Books Ltd., Harmondsworth, Middlesex, 1976); and "Conservation in Action: Report on What is Being Done in Britain's Conservation Areas" (Civic Trust, London, 1972).

⁴ David Lowenthal and Hugh C. Prince: *English Landscape Tastes*, *Geogr. Rev.*, Vol. 55, 1965, pp. 186-222.

⁵ Tony Aldous: *Goodbye Britain* (Sedgewick and Jackson, London, 1975); Colin Amery and Dan Cruickshank: *The Rape of Britain* (Paul Elek, London, 1975); John Barr: *Derelict Britain* (Penguin Books, Baltimore, 1969); and Adam Fergusson: *The Sack of Bath* (Compton Russell Ltd., Salisbury, 1973). See also Hugh C. Prince: *Reality Stranger than Fiction*, *Bloomsbury Geogr.*, Vol. 6, 1973, p. 7.

for change have increased the tools and techniques of successful preservation planning have increased as well. By the mid-1970's, preservation planning had become a sophisticated and important specialty in England.

PRESERVATION IN ENGLAND

In spite of its high regard for the past, England did not pioneer the protection of historic structures. The first legislation came in 1882 with the Ancient Monuments Protection Act, which enabled the national government (with the owner's consent) to take into guardianship or to acquire and maintain any monument on a short list of sixty-eight. Although France had "listed" buildings as early as 1840, England confined its interest almost entirely to prehistoric structures such as Stonehenge, most of which were already in ruins. The act had little impact. In 1908, half of the nation's conservation budget of £20,000 was going to the Tower of London.⁶

Not until the Ancient Monuments Consolidation Amendment Act was passed in 1913 (as a reaction to a plan to ship Tattershall Castle to the United States) was an element of compulsion introduced. Owners of listed buildings were then obliged to apply for permission to alter the property, and the government could acquire ownership or guardianship without the owner's consent. The Ancient Monuments Act of 1931 introduced some concern for context in that it authorized local authorities to protect the areas around monuments as well as the monuments themselves—a reaction to such marginally enlightened practices as strip quarrying under Hadrian's Wall. Preservation was not yet an important aspect of planning, however, and only the Depression kept such projects as the destruction of the Royal Pavillion in Brighton for a road-widening scheme from being carried out. The Germans still had many historic structures available to them when they began their infamous "Bae-decker Raids" in 1941. The raids had one positive effect in that they inspired the first systematic photographic record of English architecture.

The Town and Country Planning Acts of the 1940's provided a quantum leap in the strictness of planning controls in England. By 1947 a comprehensive list of historic buildings had been introduced, and all owners of listed buildings rated as Grade I or Grade II (the statutory list) had to apply for permission to alter those structures. Grade III buildings were those of local or group importance, and their listing was primarily to offer guidelines to local planners.

The 1953 Historic Buildings and Ancient Monuments Act authorized preservation grants (the first moneys so offered) for structural, but not cosmetic, repairs. In 1962 the procedure was expanded so that local authorities could award preservation grants to nonlisted buildings of local value. This represented the first real integration of preservation and city planning, for entire streets could be awarded preservation grants and planned accordingly. These "town schemes" usually focus on groups of listed buildings, but not all of the aided structures have to be historic. Under the town scheme program, the owner pays 50 percent of the cost of repairs and the local authority and national government pay 25 percent each. The first town schemes were launched in the mid-1960's and concentrated on classic medieval streets such as Stonegate in York.⁷

By the mid-1960's most of the magnificent historic contexts were well on the way to

⁶ Jane Fawcett, edit.: *The Future of the Past* (Thames and Hudson, London, 1972), p. 23.

⁷ Interview with June Hargreaves, Conservation Specialist, City of York, July 9, 1976.

renovation. Listed buildings were still being torn down, but they were the exception rather than the rule. Pressure for change was growing, however.⁸ The unprecedented property boom of the 1960's caused nonlisted buildings in historic urban centers to be pulled down for the construction of massive office buildings and parking garages that were in no way sympathetic with the existing scene. In addition, many buildings that qualified for town scheme grants were decaying because owners, especially in marginal, semi-industrial sections of the town center, did not see renovation as a profitable venture even with 50 percent grant aid. Thus although fine historic buildings had been protected, historic cities had not. Many were suffering a combination of massive change brought about by the property boom and stagnation and deterioration, sometimes made worse by the encumbrances of historical designation. A new approach was sought.

THE CONSERVATION AREA

The 1967 Civic Amenities Act brought a shift toward positive urban conservation over and above the protection of important buildings. According to the act, "the Minister attaches particular importance to the designation of conservation areas, which represent a shift of emphasis from negative control to creative planning for preservation. . . . Designation of a conservation area will only be a preliminary to action to preserve or enhance its character and appearance; it will be of little practical value without this."⁹ Local planning authorities were directed to adopt a positive scheme of action for each conservation area at an early stage. The words "positive" and "enhance" are important. The new emphasis was on upgrading the context of historic buildings, with the assumption that the increased economic viability of entire areas, coupled with demolition control on listed buildings, would ensure the level of investment needed to make private conservation work (especially with town scheme funds as seed money). The Civic Amenities Act, though conceptually exciting, did not arouse many cities to immediate action. Local planning authorities did not rush to create conservation areas, for many perceived them to be little more than lines on a map. Gradually, however, the concept became more tightly woven into British law.

The Town and Country Planning Act of 1968 sought to increase local participation in planning decisions by requiring public notices of demolition plans and the establishment of conservation area advisory committees, but real progress did not begin until the 1970's. The Town and Country Planning Act of 1971 (now the principal act), as amended by the Town and Country Planning Act of 1972 and the Town and Country Amenities Act of 1974, constitutes the basis for conservation area planning. With the stricter legislation came a designation boom: today more than 3,000 conservation areas exist in Britain.¹⁰

The two most important provisions in current legislation on conservation areas are conservation grants (1972) and demolition control (1974). The 1972 act authorized special conservation grants for the enhancement of conservation areas of outstanding quality (as determined by the Department of the Environment). These grants differ from town scheme grants in that they can be used not only for the repair and maintenance of structures but also for the upgrading of entire conservation areas,

⁸ Oliver Marriott: *The Property Boom* (Pan Books Ltd., London, 1967).

⁹ R. P. Thornton: *Conservation Areas: A Guide to the Legislation* (Leeds Civic Trust, Leeds, 1975), p.

14.

¹⁰ *Index of Conservation Areas*, Civic Trust, London, 1974-.

including such projects as street paving, fountains, lighting, malls, and landscaping. Obviously, all improvements should enhance the historic character of the place. Perhaps the most important conservation area tool came with demolition control in 1974. The act reads: "Anyone wishing to demolish a building within a conservation area must first apply for listed building consent to the local planning authority. . . . In assessing whether or not consent should be granted, authorities should take into account the importance of the building to the character or appearance of any part of the conservation area."¹¹ Not only is the conservation area now a legal entity like the statutory list, but permission to demolish is linked to the acceptability of new development. "Demolition of a building will not always be followed by redevelopment of the site, but where it is clear that it will be . . . in general, consent to demolish should only be given where there are acceptable and detailed plans for that redevelopment."¹² This is an important point. Demolition control is tied not only to "historical" value but also to the concept that each wave of new construction should be equal to or better than the last.

By 1974, local planning authorities had complete control over what could be torn down and what could be built in conservation areas and, in the case of outstanding areas, over sizable amounts of money to improve them. Because conservation areas represent a national legislative decision, cities do not have to worry about liability or other legal problems, but because they are locally administered, cities have control over their own destinies.

DESIGNATING CONSERVATION AREAS

Conservation area legislation is remarkably free of the complicated procedures that normally accompany statutory planning. Unlike the listing of historic buildings, which is decided by the central government and is put as a charge on local planning authorities, conservation areas are identified entirely at the local level. Although the Department of the Environment and the Civic Trust provide a considerable amount of advice, standards seem to vary in direct proportion to the personalities of local planning officers and amenity societies. Designation has been rampant in some areas and nonexistent in others. Designation requires no sophisticated analytical techniques; and although some authorities like to give the impression that science might somehow be involved, others simply draw lines along convenient boundaries. No guidelines for the size of conservation areas exist: some cities have drawn tight boundaries around architectural specimens, but others have included large areas of developable land in order to exercise stricter development controls. It costs nothing to designate, but most local authorities cannot spare full-time staff for serious conservation and so, in some cases, the credibility of the original concept may be stretched.¹³

Although conservation areas are found in almost every type of setting, the most important nationally are those that include the commercial center of a freestanding town or city. These are also among the most difficult in which to manage change because they are large enough to be under considerable economic pressure both to change and to remain unchanged (as opposed to, say, a rural village). The capacity of

¹¹ Thornton, *op. cit.* [see footnote 9 above], p. 8.

¹² *Ibid.*

¹³ David Gamston: *The Designation of Conservation Areas* (Inst. of Advanced Architectural Studies, York, 1975), p. 54.

such a commercial center to grow and change can affect the entire city, for economic activities may threaten to move if preservationists are obstinate (often the cause of considerable conservation undoing).

In the remainder of this paper I shall examine attempts to manage change in three medium-sized English cities with all or most of their commercial centers in conservation areas. Bath, Chester, and Norwich represent different types of conservation problems and different responses to those problems (Fig. 1). Bath has experienced massive commercial renewal in its core while successfully preserving peripheral residential neighborhoods. Chester has preserved the atmosphere and sense of place of its core while experiencing substantial commercial infill, but its residential areas have been neglected. Norwich has emphasized "vest pocket" preservation and housing infill in its core while channeling massive commercial developments into an inner ring.

BATH: MASSIVE CHANGE IN A SACRED CITY

Of all the historic cities in England, Bath has the least capacity for change. About half of the city is in a conservation area, and it is completely surrounded by a greenbelt. Roughly two-thirds of the city is subject to some kind of special control. It is also the city where controversial change has come both suddenly and massively.

Bath was founded by the Romans as a spa, and the curative powers of its waters were acclaimed throughout medieval times. Bath, ironically the city that now has the most problem with change, is the city that has changed most in the past. In medieval times it was not large (by 1668 it had a population of only 1,200), but it boomed after Beau Nash arrived in 1703. Nash introduced elegance and gentility to the hitherto raucous bathing scene. He built an assembly hall and a pump room and issued strict dress codes for bathers. Nash, along with Ralph Allen, John Wood, John Wood the Younger, and others, largely erased Bath's medieval heritage and built in its place a Georgian city modeled on the grandeur of Rome. By 1729, the Palladian building boom was well under way. As the reputation of Bath as a fashionable spa grew, so too did the number of crescents, squares, terraces, and parades (Fig. 2). Within the span of a hundred years, Bath was largely rebuilt and greatly expanded in a uniform Georgian style that used only yellow Bath stone. It was an achievement in town planning unrivaled in Britain—but then, as now, such massive change was not universally admired. Writing in 1769, Matthew Bramble complained: "I find nothing but disappointment at Bath, which is so altered that I can scarce believe it is the same place that I frequented thirty years ago. . . . The same artist who planned the Circus has likewise projected a Crescent: when it is all finished we shall probably have a star and those who are living thirty years hence may, perhaps, see all the signs of the Zodiac exhibited in architecture at Bath."¹⁴ Bath lost much of its popularity in the nineteenth century, and so the Georgian/Zodiac city remained frozen in uniformity until after World War II. Its uniformity is the problem (Fig. 3). The less gradual change a place has experienced in the past, the less gradual change it can accept graciously in the future. Bath seems destined for cycles of abrupt renewal, a source of great frustration for planners and preservationists alike.

Still largely intact after the Baedeker raids, Bath began to change in the 1950's. The 1960 plan noted that 480 dwellings had been torn down since 1951 and advocated

¹⁴ "Bath: A Study in Conservation" (Colin Buchanan and Partners, London, 1968), p. 1.

the demolition of 2,600 more for highways and other projects.¹⁵ Bath in 1960 was ancient, tattered, and bursting at the seams. "The homogeneous building stock is homogeneously obsolete, 40 percent of the floor space in the central area is vacant,

GENERALIZED PATTERNS OF PRESERVATION AND RENEWAL

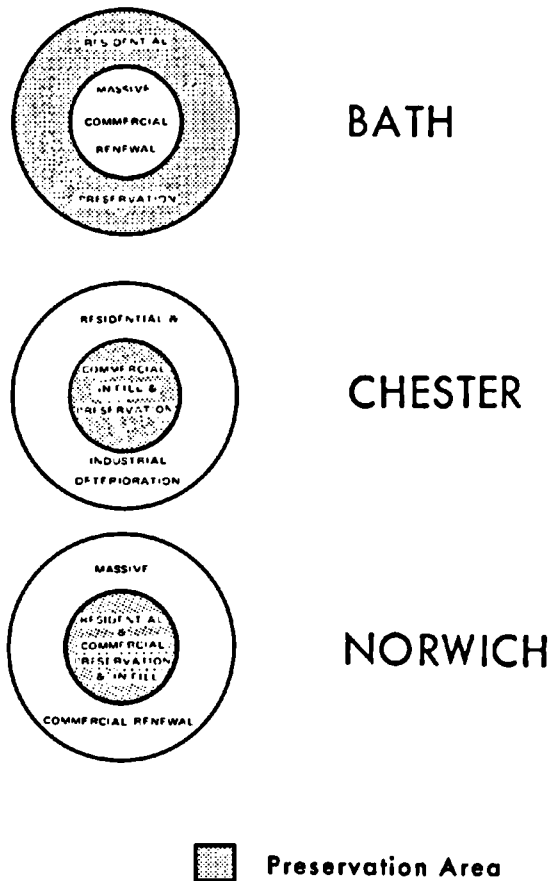


FIG. 1

and much more of the remainder above the ground floor is in nominal use. Were ordinary legal standards applied, Bath would have to be rebuilt. . . . The town, like a stage set, lacks the historic depth and living presence that is felt in an active, complex city."¹⁶ Kevin Lynch, as well as others, was concerned that conservation subsidies would lead only to an "elegant tourist encampment," while most urban functions

¹⁵ Fergusson, *op. cit.* [see footnote 5 above], p. 66.

¹⁶ Lynch, *op. cit.* [see footnote 1 above], p. 9.

moved elsewhere, perhaps to nearby Bristol. Change came, however, and in the late 1960's and early 1970's almost all of south central Bath was rebuilt (Fig. 2). City officials explained that the rising tide of public indignation was attributable not to

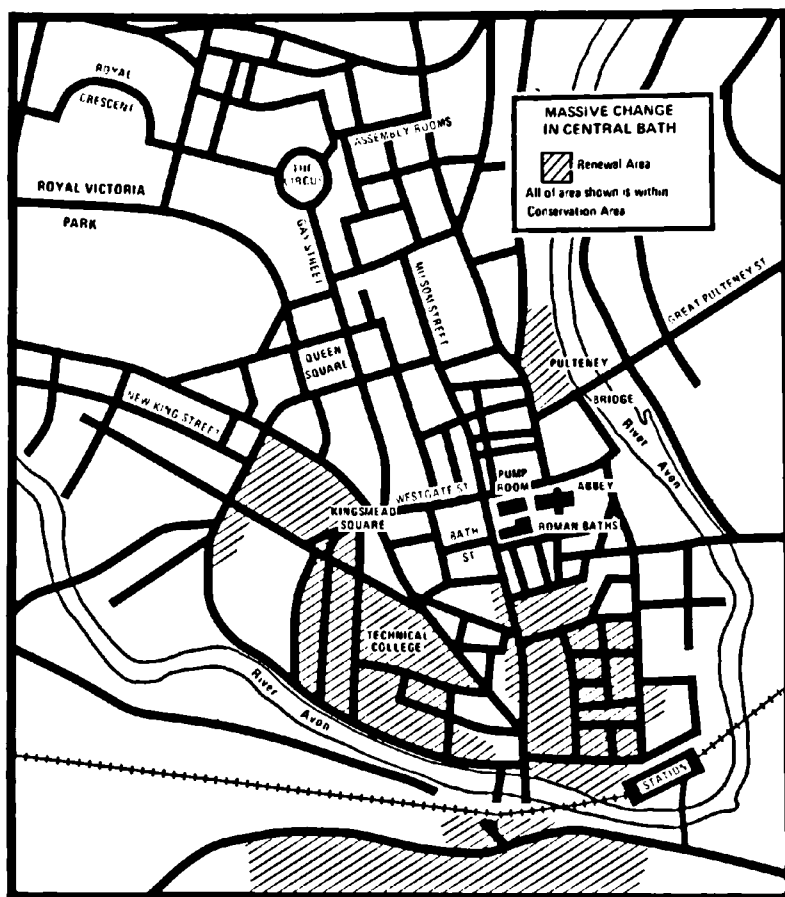


FIG. 2

council policy but to the fact that so much of the new development happened to be coming to a head at the same time.

Much of the public was overwrought. Adam Fergusson, in his widely read and influential book, "The Sack of Bath," complained of the wholesale destruction of middle-class Bath. "Today, artisan Bath is largely rubble. Acres upon acres of the Georgian city's minor architecture have been flattened in the course of a decade and a half. . . . In few places has the notion of urban renewal been applied with such destructive vigor as here, or with such callous disregard for the finer subtleties of urban charm."¹⁷ The antagonistic relationship between preservationists and the city was due partly to some acts by the latter which were seen as being in dubious taste. For example, in 1967 the city burned down a perfectly sound building in order to test

¹⁷ Fergusson, *op. cit.* [see footnote 5 above], p. 12.



FIG. 3—Architectural uniformity in Bath: Georgian terraces on Paragon Street.



FIG. 4—Modern commercial buildings in the Bath renewal area.

the fire resistance of Georgian structures. The building lasted ten minutes longer than regulations required.

Next to the massive scale of change, the biggest problem in Bath is the mediocre quality of new construction. Asked in 1972 of which of the buildings in the modern idiom the city was really proud, the then chairman of the development committee answered, "None."¹⁸ Most, if not all, of the new buildings have been built in yellow Bath stone with gray mansard roofs. At best they can be described as attempts to continue the basic color scheme of the city and at worst as bulky, out-of-scale, imitation Georgian. Bath is definitely not becoming a center of interesting modern architecture (Fig. 4). Although it is not really losing the best of the old, it may be getting the worst of the new. Recently the council balked at accepting as justification for a project the statement that "anyway in summer it would be hidden by trees."¹⁹ Much of the problem stems from the difficulty of inserting new architecture into an architecturally uniform setting. The city abounds with low-quality replicas of itself.

Bath, unlike most historic cities, has a conservation area that focuses on residential neighborhoods such as the Circus and the Royal Crescent. The original conservation area of 432 acres designated in 1968 did not include the commercial core that has since been renewed. Critics claim that the original conservation area was drawn to exclude areas ripe for redevelopment. By 1975 the conservation area had been expanded to 3,362 acres and included all of the central city, but massive redevelopment had already taken place.

The residential character of Bath's historic buildings is part of the problem. Approximately 67 percent are residential, as opposed to only 24 percent in both Chester and York.²⁰ Buildings that contain shops and offices can often be renovated for a profit, but buildings that house people are generally more of a problem, especially with England's strict rent controls. Before redevelopment, Bath simply had too much historic residential space (more listed buildings than any other English city) and not enough good commercial space. Bath built a downtown to go with its residential spa.

Outside the central redevelopment area, historic Bath is in good shape. It has pioneered the conversion of historic structures to council housing because Georgian buildings are considerably more appropriate for this than, say, medieval cottages. Such conversions mean that Bath is able to use housing funds from the central government rather than limited conservation funds for much maintenance work. Conservation funds have been used for such things as an expensive program to clean stone facades, which has brightened up the city considerably. The population of the core area dropped from 4,885 in 1951 to 4,130 in 1971, but this represents a rather gradual decline compared with most historic English cities as thousands of dwelling units have been successfully renovated and converted.

Change has never been and probably never will be easy for Bath. Change was painful and abrupt in the eighteenth century and in this century as well. Conservation area planning, though not apparently too enlightened in Bath until recently, could not cope with the pain of change there. Now that the main burst of change is past, conservation and preservation planning should function more smoothly. Perhaps

¹⁸ *Ibid.*, p. 16.

¹⁹ *Ibid.*, p. 73.

²⁰ Roy Worskett: Great Britain: Progress in Conservation, *Arch. Rev.*, Vol. 157, 1975, p. 13.

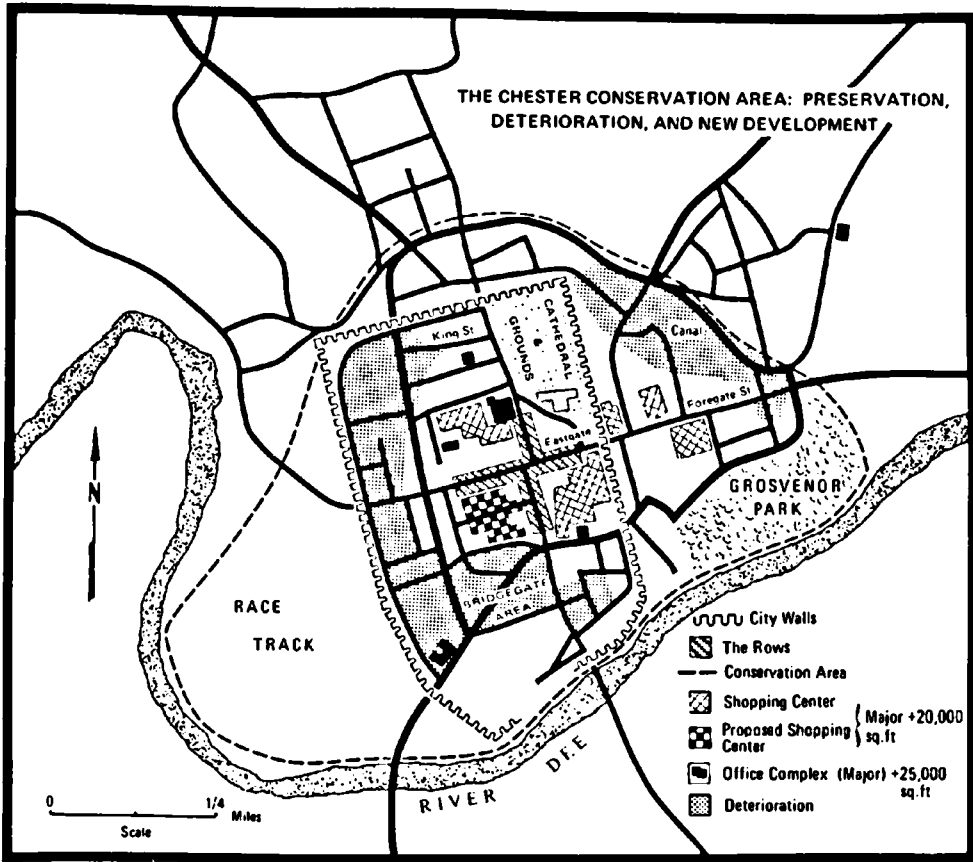


FIG. 5

places which are designed to be seen as a whole and which contain buildings from one architectural era, of one size, made of one material, and built primarily for one use cause difficult problems, because capacity for change may well be a function of existing diversity. Planning at the outset for gradual modification and infill might be a good idea.

CHESTER: COMMERCIAL INFILL BEHIND THE ROWS

Of the historic cities in England, Chester is considered by many to have accomplished the most creative conservation area planning. The city has given political backing to conservation. Moreover, it is the only city to have a special conservation tax to help pay for preservation projects and a full-time conservation expert to act as a catalyst and liaison to inspire and encourage private preservation activities. In addition, the planning department has a staff of seven preservation specialists (including practical professionals such as stonemasons), who help keep the city's ideas realistic. Chester has managed to develop a creative climate in which significant renovation projects and new architecture blend relatively successfully in the conservation area. Just as many of the problems in Bath were due to the character of the place, however, so too are many of the successes of Chester. Past is prologue.

The Romans founded Chester (Deva) and gave it the basic rectangular street pattern it has today. Parts of the still-intact city wall follow the old Roman wall (Fig. 5), and Roman ruins have been unearthed and tastefully displayed in gardens of antiquity. Roman imagery constitutes an important part of the Chester sense of place.

Although Roman Chester provided the city with its plan, it was medieval Chester (perhaps with the aid of Roman ruins) that gave the city its dominant architectural themes—Tudor “black and white” and The Rows. Chester was a prosperous port from the twelfth to the sixteenth century, but when the River Dee began to silt up in the 1550’s the city declined. Its fate was sealed by the rise of Liverpool in the eighteenth century. As Chester became increasingly landlocked, it became increasingly “frozen” in Tudor wattle and daub.

As Chester became easily accessible through rail connections and as Liverpool, Manchester, and other nearby cities became huge megalopolises in the mid-nineteenth century, Chester’s picturesque cityscape came to be perceived as ideal for Victorian romanticism. Even in 1831 Chester was described as a “favoured residence of many wealthy families” as the city inched toward a reputation for fashionable commerce.²¹ Victorian architects such as John Douglas (1820–1911) and T. M. Lockwood (1830–1900) began to build large numbers of romanticized “mock-Tudor” structures reminiscent of Chester’s medieval glory. With only a handful of authentic Tudor structures remaining, Chester has a reputation as one of the chief black-and-white cities of the realm. Throughout the Northwest it is recognized as a fashionable shopping center.

Two characteristics are primarily responsible for the continuing popularity of Chester as a place: its completely intact city walls and The Rows. The wall is perfectly suited for strolling, and an increasing number of pubs and shops are being built there in order to cater to the needs of the promenaders. The Rows, however, are what make Chester unique (Fig. 6). Dating from medieval times, The Rows consist of a double tier of shops, one at ground level and the other above and behind it, so that the roof of the lower shop is a covered footway for the upper shop. This continuous line of balconies at the second-floor level makes it possible to stroll there unmolested by traffic or to linger with a pint and a view of the streets below. Traditionally, the higher-class shops were in the “upper” Row and the mundane world occupied the muddy, unprotected streets below.

The origin of The Rows has never been satisfactorily explained, though many ingenious theories have been put forward. One of these is that The Rows developed as a response to the existence of massive Roman ruins lining the streets because The Rows are found only within what was once the Roman fortress. Medieval inhabitants, unable or unmotivated to move either the ruins or themselves from the place, simply built around them. As The Rows emerged, they were no doubt found useful and were maintained. Covered shopping was soon recognized as a treat in that wet land, and as soon as the trains arrived, so too did the shoppers. The Rows also add to the historical authenticity of Chester, for even when the facades are blatantly Victorian it is possible to think that the buildings are somehow the result of real medieval attempts to deal with real Roman ruins. Several Victorian buildings have medieval structural fragments on display, giving Chester the character and depth of a temporal potpourri.

Chester is not without aesthetic difficulties. During the 1950’s and 1960’s the city began to experience massive change. Blocks of high-rise council housing rose near the

²¹ “Chester: Heritage City” (Chester City Council, Chester, 1976), p. 22.

city wall, a motorway sliced through the center of town, a ten-story office building was built across the street from the cathedral, the old market was demolished, and people began to move in numbers from the historic core.²² Health officials ruled that much of the old city was "unfit," owing to a paucity of such things as indoor toilets. The residential population of the conservation area plummeted from 2,000 in 1968 to 600 in 1976 (with only about 200 living within the city walls), and there was concern that Chester was becoming little more than a large medieval shopping center.²³ By 1971 Chester had the highest per capita retail sales in the Northwest.²⁴ In addition, almost 500,000 square feet of office space have been built in the conservation area since 1961. However, though retailing has boomed over the past decade, with more than 350,000 square feet of space built and another 125,000 approved, only one small housing project has been constructed in the old city.

The completion of the inner-ring highway in the late 1960's served to concentrate the retailing/office boom in the heart of historic Chester. Although the highway relieved congestion and made it possible to pedestrianize some shopping streets, it also cut off some areas such as Bridgegate (Fig. 5). Suddenly these areas became peripheral even though they were inside the city walls. Abandonment and underinvestment grew, despite the general property boom. The problem is both simple and common: too much commercial investment in a small "heartland" and too little in the surrounding "rimland." Everyone wants to link up with The Rows in order to maximize sales, so unlike Bath, where historic buildings may suffer from being undervalued, The Rows of Chester may be overvalued. The rent gradient outward from The Rows is steep, dropping from £3 per square foot to £1 per square foot in a few blocks.

In 1968, when Chester delimited its 200-acre conservation area (containing 600 listed buildings), it was in the midst of an important conservation controversy. The building of the massive Grosvenor-Laing complex of shops, offices, and multistory parking, however, turned out to be a seminal event. The initial plan called for the destruction of several Row buildings along Eastgate, "the" street in Chester, along with the elimination of another street for a superblock complex. This crisis provided much of the enthusiasm for conservation area planning in Chester. Although the shopping superblock was built, the facades of The Rows (if not always the entire buildings) were saved as the new complex went in behind them. Today the huge, modern shopping center is virtually surrounded by Rows, by facades of Rows, and by the city wall. Most of the new shops were built at the level of the upper Row, providing an aesthetically and functionally continuous shopping center complete with heated pavements and underground servicing. Plans now call for the same arrangement behind The Rows across the street. The Row theme has become sacred and unchangeable, whether or not the individual buildings are saved.

Conservation area planning in Chester involves more than hiding shopping centers behind The Rows. The city has taken on the renovation of some of the more important buildings, in some cases cooperating in joint schemes with private co-owners. In other cases, permission to destroy mediocre Row buildings has been granted if the developer agrees to build a better building that would perpetuate The

²² Chester: A Study in Conservation [see footnote 3 above].

²³ Interview with Gus Astley, Conservation Specialist, City of Chester, July 3, 1976.

²⁴ "Chester City Study" (Cheshire County Council and the Council of the City of Chester, Chester, 1975).



FIG. 6—Central Chester: Neo-Tudor architecture and The Rows.



FIG. 7—Residential deterioration on King Street in Chester.

Row. These new buildings need not be neo-Tudor, just good architecture. In this way Chester flows along with the stream of time while protecting its sense of place. In still other cases, developers are given permission to build new buildings in an historic context if they agree to renovate the often sagging building(s) next door. Significant grant aid both from the central government and from the city's special conservation tax has been heavily used in The Rows, thus making planning "advice" a great deal more palatable.

Although preservation of The Rows is proceeding nicely, much of the periphery of Chester's conservation area is in bad shape. The Bridgegate area, cut off from the shopping core by the inner-ring road, suffers from both the blight of long-standing neglect and the intrusion of incompatible buildings and land uses. Designated a special conservation pilot project for the European Architectural Heritage Year, the city is working toward a comprehensive program for renovation and new development there. Although the five-year program is still in the early stages of implementation, success has so far been limited. Environmental enhancement projects such as planting and resurfacing are proposed but have not taken place, and most of the actual renovation in the area has been carried out by the city. Private investment is still heading for the extremely compact shopping core (Fig. 5).

Bridgegate is not the only problem area. The sagging houses on King Street have been propped up with large wooden beams for about ten years with no immediate salvation in sight, and the residential/industrial area that straddles the canal is a scene of almost total deterioration, with boarded-up houses and empty warehouses everywhere (Fig. 7). In addition, several of the new chain stores along Foregate are aesthetically marginal. Conservation area planning in Chester began at the center and is only gradually being implemented in peripheral areas.²⁵

Change in Chester is very different from change in Bath. Bath has proved to be inhospitable to massive commercial change in its core, but in Chester such change has been stitched into the urban fabric with considerable skill. In Bath the residential squares and terraces have proved to be easily renovated for continued use as housing, but in Chester residential streets have taken a "back seat" to the more important and visible Rows. These differences are due both to the character of the places and to the quality of the conservation area planning. All in all, Chester seems rather more amenable to change than Bath. Chester is a polyglot "temporal potpourri" that accepts modern architecture gracefully, but there is danger that renovation and infill will concentrate on The Rows to such an extent that Chester will lose its urban diversity and become an eight-hour shopping center surrounded by parking garages and abandoned buildings. Just as in Bath, a balance is sometimes difficult to achieve in a valuable and historic setting.

NORWICH: CITY OF INFILL HOUSING

Norwich is the largest of the three cities studied. It has been the undisputed central place for East Anglia since medieval times; and today, with a population of 119,000 and a "metro" population of 260,000, it seems to be under more pressure to change than Bath and Chester are. With 235,000 square feet of shopping space constructed since 1971 and more than 1,000,000 square feet of office space under construction in

²⁵ Anne Dennier: Chester: Conservation in Practice, *Town Planning Rev.*, Vol. 46, 1975, p. 390.

1976 alone, Norwich has passed the big-city threshold.²⁶ In the face of such growth the city has undertaken some interesting projects.

Norwich is a medieval city *par excellence*. By the 1600's, with 21,000 inhabitants, it was perhaps the largest provincial city in England, and many late medieval cottages and twisting lanes remain from this period. Medieval Norwich was a diverse city: textiles, banking, leather, insurance, food processing, and engineering provided its economic base. Although Norwich experienced a period of relative stagnation during the nineteenth and early twentieth centuries, it did not sit out the Industrial Revolution to quite the extent that Bath and Chester did. Large areas of central Norwich were given over to factories and warehouses, and the city walls were removed in about 1800 to facilitate commerce. Nevertheless, the rise of the textile industry in the Midlands and the growth of such nearby ports as Hull took much pressure to change off Norwich until the rise of its office industry in recent years.

The "old city" of Norwich has three distinctive focal points: the castle, the cathedral, and the town hall/market place (Fig. 8). In between, and spilling across the River Wensum, lies medieval Norwich. Today, this medieval core is largely a specialty retailing area with a liberal sprinkling of small offices and residences. The conservation area has been drawn to include not only the medieval core but also a buffer zone marked for "enhancement." Most of the large office and retailing buildings have been built to the south of the conservation area along St. Stephens or, more recently, to the north of it in Anglia Square, a planned commercial center. Massive change in Norwich is taking place in an inner ring just beyond the historic core and its conservation area. Although the core is an eclectic area with buildings from every era, its small scale and narrow streets help to preserve a medieval ambience (Fig. 9).

Norwich has long been a pioneer in preservation planning. In 1927 the city purchased properties on Elm Hill and created one of England's first renovated medieval districts. In 1957, the newly active Civic Trust joined with the city to sponsor a "paint up-fix up" project on Magdalen Street, one of the first such ventures in the modern conservation era to use town scheme grants effectively.²⁷ Over the years several architectural firms in Norwich have gained a great deal of expertise in the "renovation and sympathetic new construction" field, and this plays an important part in making conservation area planning work. In addition, the disorderly yet picturesque layout of the city affords many opportunities for hiding some things while accentuating others.

As in Bath and Chester, massive change has brought some problems in Norwich. It is wildly overbuilt. More than 500,000 square feet of office space are vacant in the new buildings alone, and half of the retail space in Anglia Square has yet to be rented. This glut works a hardship on conservation projects. Several nicely renovated offices are empty because there are not enough tenants to go around. Although renovated buildings in the core are doing well, several of the older, peripheral streets such as Pottergate and St. Benedicts are badly in need of economic rejuvenation.

A second problem is the generally decrepit condition of the entire "North of the River" part of the old city, where industry located in the nineteenth century. As many of the industries began to leave for the suburbs, the city was faced with reclaiming the area for new uses. The reclamation has worked so well that the city is now persuading industries to leave through such procedures as land swapping. A third problem has

²⁶ Interview with Tim Craig, Norwich Planning Department, Aug. 12, 1976.

²⁷ "Pride of Place" (Civic Trust, London, 1974), p. 12.

been population decline in the historic core. The population of the old city dropped from 12,000 in 1951 to 4,000 in 1971. Since then, however, the trend has been reversed: the current estimate is about 6,000.

In the field of conservation area planning, Norwich is known primarily for its creative attempts to insert new housing into historic settings. No discussion of these

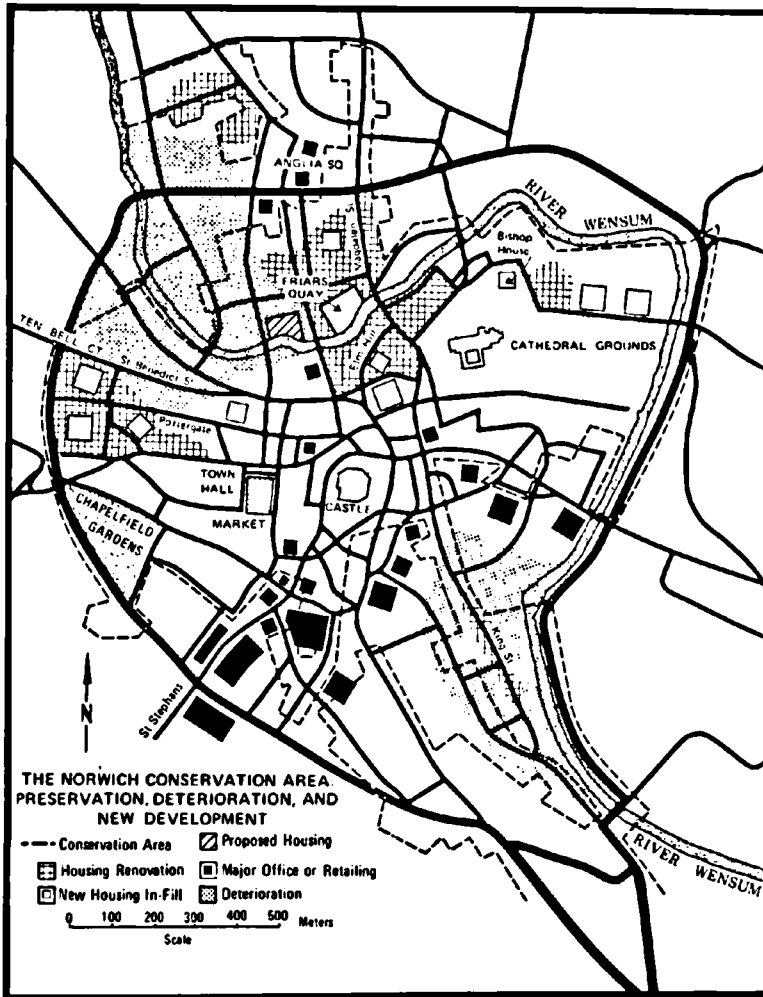


FIG. 8

immaculate insertions would be complete without some mention of Great Britain's increasingly tough and comprehensive rent control statutes, which now apply to almost every type of habitable premise. These laws serve both to control rents and to provide tenant security. For all rentals except those in the luxury category, a Rent Control Board can establish a "fair" rent, usually at a level far lower than owners would like (and perhaps need) to keep property well maintained. In addition, tenants may not be turned out against their will. As a result, it is virtually impossible for the



FIG. 9—Eclectic architecture in central Norwich.

private sector to supply much housing, especially high-quality renovated housing, to the rental market. It is especially difficult to persuade people with excess space, say rooms over a shop, to rent that space because they may not be able to stop renting it when they want to. And so an immense amount of space is vacant while the populations of most historic core areas plummet. Housing that is built or renovated in the central city tends to be for sale at relatively high prices. In both Bath and Norwich almost 50 percent of all housing is council housing governed by strict cost guidelines. Neither renovated housing nor sensitively designed infill housing can be part of the council housing program because of "aesthetic frills." Bath is an exception, owing to its "national treasure" status and the easy convertibility of its Georgian housing stock. Conservation would be far more successful if housing subsidy funds were more readily available.

The brightest spot in this picture is the housing associations. These nonprofit organizations can, by obtaining government grants, provide some housing for the rental market. Norwich appears to have more than its share of energetic and enlightened housing associations, and much housing there is a result of their work.

The biggest project in Norwich conservation area planning is the Heritage Over the Wensum scheme.²⁸ This is a £2,000,000 joint effort, involving the city, private developers, the Norwich Preservation Trust, and other community groups, to "recapture" the derelict mixed industrial zone north of the River Wensum. The three-phase project involves forty-seven different restoration and new construction efforts by

²⁸ "Heritage Over the Wensum" (Norwich Council, Norwich, 1975), pp. 1-35.



FIG. 10—New houses and flats in the Friars Quay Redevelopment Project, Norwich.



FIG. 11—New housing infill surrounded by older, preserved buildings in Ten Bell Court, Norwich.

eleven different agencies. Although new offices, shops, and pubs have been created in the one-third-square-mile area, the emphasis is on housing.

The most visible and highly acclaimed project in Heritage Over the Wensum is the Friars Quay complex (Fig. 10), a group of forty houses and flats built on the site of an old lumberyard next to the river. Although the steep-roofed, red-brick houses are not replicas, they were designed to capture the essence of medieval aesthetics—and they do. The houses were built for sale and prices range from £8,000 for a flat to £24,000 for a large house.

Throughout the Wensum area, small pockets of restoration and new construction are occurring. Rather than using the massive clearance techniques so popular in English urban renewal projects in the 1950's and 1960's, the Wensum program emphasizes careful selection of buildings worthy of restoration mixed with small pockets of land suitable for sympathetic new construction. Fear of massive, uncontrollable change is thus avoided. The secret seems to lie in keeping tight boundaries for all schemes, in order to check the specter of rampant speculation and massive change. For example, the Friars Quay project involves not only 40 new units but the restoration of most of the buildings on adjacent St. Georges and Colgate streets. So far the Wensum project has created about 50 units of new housing and 50 units of restored housing, and plans call for a 122-unit development along the river. When the project is complete, the population of the area will have risen from about 300 to 700, with rents ranging from expensive to quite reasonable.²⁹

Creative infill housing in Norwich is not confined to the Wensum project. In every part of the historic center, small parcels of land are being used for residential developments of all kinds (Fig. 11). The typical medieval city featured row houses flush with the street, with surprisingly large gardens to the rear.³⁰ Through the years, most of those gardens were given over to parking, storage, and weeds, especially where the houses became commercial. Norwich is making a concentrated effort to fill these interior blocks with housing while renovating the buildings and facades on the "traditional" streets. Such housing, in projects ranging in size from 8 to 108 units, can be found in all sections of the historic core. In some cases the architecture is daring and ultramodern, but in almost every case the design is sympathetic to the historic character and scale of its setting.

Altogether, approximately 500 dwelling units have been added to central Norwich through creative infill and renovation. Although some shops and offices have also been added, it is in the area of housing that the Norwich approach is unique (Fig. 8). Norwich has also had considerable success with the enhancement of conservation areas. Pedestrianized streets, special lighting programs, beautification of river walks, and landscaping have made revitalization of the historic core easier. Norwich is managing change quite successfully.

CONTINUITY AND CHANGE

Change is taking place in every historic city, but the type, rate, and impact of change varies from place to place. Differences are due to the character of the places themselves as well as to varying change management policies. Although England has national laws that deal with the designation and administration of conservation areas,

²⁹ *Ibid.*

³⁰ J. E. Vance: *This Scene of Man* (Harper and Row, New York, 1977), p. 125.

local authorities have great leeway in deciding how change should be managed. This flexibility is limited, however, by intrinsic differences in the nature and scale of the cities being managed. Historical variations in the structure of land parcels, in the siting and size of buildings, in functional organization, and in architectural ideals can have a lasting impact on a city's capacity for change. We need to better understand which types of cities are able to accept change easily and which cannot, and why. We need to know how to build cities that are not only beautiful and functional but also changeable, lest they become obsolete burdens in the future. In order to understand the pressures and problems of change, we must study those places that are coming to grips with preservation planning. The spatial structures and architectural images of Bath, Chester, and Norwich are becoming more divergent as change is managed differently in each, and the techniques being developed there may well be applicable to cities elsewhere.

Our cities should provide visible clues to where we have been and where we are going. Just as we should not erase our past and destroy our roots, we cannot live only in a frozen, romanticized setting of the past. We must learn to design cities that can maintain a sense of place while accepting gradual change. The English are working on it.

SLOW GROWTH: A NEW EPOCH OF AMERICAN METROPOLITAN EVOLUTION*

PHILLIP D. PHILLIPS and STANLEY D. BRUNN

IN a landmark article John Borchert divided the evolution of the urban system in the United States into four major epochs: the Sail-Wagon Epoch, 1790 to 1830; the Iron Horse Epoch, 1830 to 1870; the Steel-Rail Epoch, 1870 to 1920; and the Auto-Air-Amenity Epoch, 1920 to the 1960's.¹ Each of the four epochs was characterized by a set of distinctive economic/technological, demographic, and geographical patterns that affected the regional and internal structure of urban growth. Cities grew, or declined, in response to innovations, especially those in industrial energy sources and transportation technology. Borchert described the importance of such innovations as follows:

When some basic component of the nation's society or economy or technology "turns a corner" and a new epoch opens, a new set of overriding and "long-term" forces goes into effect. Thereafter, one might expect past growth to cease to be a good predictor. At the least, its validity would have to be reestablished with a new set of conditions.²

Cities thus reflect the technologies and socioeconomic characteristics of the times in which they emerged. The passage between epochs is a transition period in which significant technological, economic, and social trends change. As each new epoch finds expression in the metropolitan system, parts of cities and some entire cities and regions retain the dominant structures of past epochs and become "inhabited ruins."³

Our thesis is that a new epoch of American metropolitan evolution is beginning to unfold. This new epoch, which we term the "Slow Growth" Epoch, is a distinct departure from the Auto-Air-Amenity Epoch described by Borchert. The two most important technical, social, and economic forces producing this new epoch are slower increase of population and slower increase of energy supplies. Contributing to or secondary to these two basic characteristics are declining fertility through increasing use of birth control, depletion of fossil fuel reserves, movement out of metropolitan areas, substitution of communication for transportation, and growth of the Sun Belt at the expense of the traditional Manufacturing Belt.⁴

* The authors thank their numerous colleagues, especially John R. Borchert, whose ideas, insights, and comments improved the content and form of this paper immensely. We also thank the staff of the cartography laboratory at Michigan State University for their invaluable assistance in preparing the graphic materials.

¹ John R. Borchert: American Metropolitan Evolution, *Geogr. Rev.*, Vol. 57, 1967, pp. 301-332.

² *Ibid.*, pp. 325-327.

³ *Ibid.*, p. 329.

⁴ All regional census data in this article are for standard, multistate divisions used by the U.S. Bureau of the Census. The terms "Manufacturing Belt" and "Sun Belt" are also used in this article but much less specifically. Although these terms are frequently used in the popular press they are not precisely defined. The traditional Manufacturing Belt, which roughly coincides with what has also been termed the "Snow Belt," "Frost Belt," "Northern Perimeter," and "Heartland," includes an area approximately defined by a quadrilateral with its corners at Baltimore, St. Louis, Milwaukee, and Portland, Maine. The Sun Belt,

The Slow Growth Epoch, like previous epochs, is producing new boomtowns despite overall low growth rates—retirement villages, mining towns in the sub-bituminous coal areas of the West, and new boom cities in the Sun Belt. Growth of boom centers is balanced by older manufacturing cities that have become bust centers on a far more wide-reaching scale than ever before as absolute population decline has overtaken the entire Northeast census division. Pressures toward a new pleasure-seeking, rural-oriented life-style have differentiated older metropolitan regions internally, producing a new, peripheral development of recreationally oriented communities, which have been termed “hedonopolises,” around declining traditional metropolitan regions.⁶

The arrival of a Slow Growth Epoch for the American metropolitan system is dramatically reflected in population estimates for Standard Metropolitan Statistical Areas (SMSAs) for the period from 1970 to 1975. The annual growth rate for all SMSAs was 0.8 percent in the first half of the 1970's, as compared with 1.6 percent in the 1960's. This decline in growth rate was accompanied by an increase in the number of SMSAs showing absolute population decline, from twenty-seven in the 1960's to forty-two in the 1970-1975 period. Moreover, SMSAs with more than 2 million inhabitants and SMSAs of all sizes in the Northeast census division showed an overall population loss (Figs. 1, 2, and 3).⁶ This unprecedented decline in population for many SMSAs stems from both a decline in rates of natural increase and a shift in net migration to small cities and rural areas.

In this article we will discuss in detail the nature of the forces that have produced the Slow Growth Epoch of American metropolitan evolution, the impact of slow growth on the nation and its metropolitan regions, and the longer-range impact of slow growth on the character and geographical structure of America and its cities.

THE CAUSES OF SLOW GROWTH

Increasingly well developed technologies of birth control, including acceptance of the birth control pill, sterilization, and abortion, have contributed to a rapid decline in crude birthrates per 1,000 population for the nation as a whole from 25.0 in 1955 to

alias “Rimland” and “Southern Perimeter,” has been variously and loosely defined and is often used as an evocative rather than a precise regional term. In its most restrictive sense the Sun Belt is an area from the Carolinas west to Texas. More generally, the Sun Belt is expanded to include all of the southern portion of the country, from the Carolinas to California. Often the Sun Belt refers simply to all areas of the United States outside the traditional Manufacturing Belt. In this latter sense, Manufacturing Belt and Sun Belt represent a heartland-rimland dichotomy.

⁶ John W. Sommer: *Fat City and Hedonopolis: The American Urban Future?* in *Human Geography in a Shrinking World* (edited by Ronald Abler, Donald Janelle, Allen Philbrick, and John Sommer; Duxbury Press, North Scituate, Mass., 1975), pp. 132-148.

⁷ Annual estimates of population, net migration, and natural increase for SMSAs are found in *Current Population Repts., Ser. P-25*, U.S. Bur. of the Census, Washington, D.C. A number of works commenting on the rapid decline of American metropolitan population growth have appeared recently. Among these are William Alonso: *Urban Zero Population Growth*, *Daedalus*, Vol. 102, 1973, pp. 191-206; Brian J. L. Berry: *Aging Metropolis in Decline*, *Society*, Vol. 13, No. 4, 1976, pp. 54-56; Edgar M. Hoover: *Reduced Population Growth and the Problems of Urban Areas*, in *Population, Distribution, and Policy: The Commission on Population Growth and the American Future Research Reports* (edited by Sarah Mills Mazie; U.S. Govt. Printing Office, Washington, D.C., 1972), pp. 427-542; William H. Miernyk: *Decline of the Northern Perimeter*, *Society*, Vol. 13, No. 4, 1976, pp. 24-26; Peter A. Morrison and Judith P. Wheeler: *Rural Renaissance in America? The Revival of Population Growth in Remote Areas*, *Pop. Bull.*, Vol. 31, No. 3, 1976; and Edgar Rust: *No Growth: Impacts on Metropolitan Areas* (Lexington Books, Lexington, Mass.,

POPULATION CHANGE IN SMSAs, 1960-1970

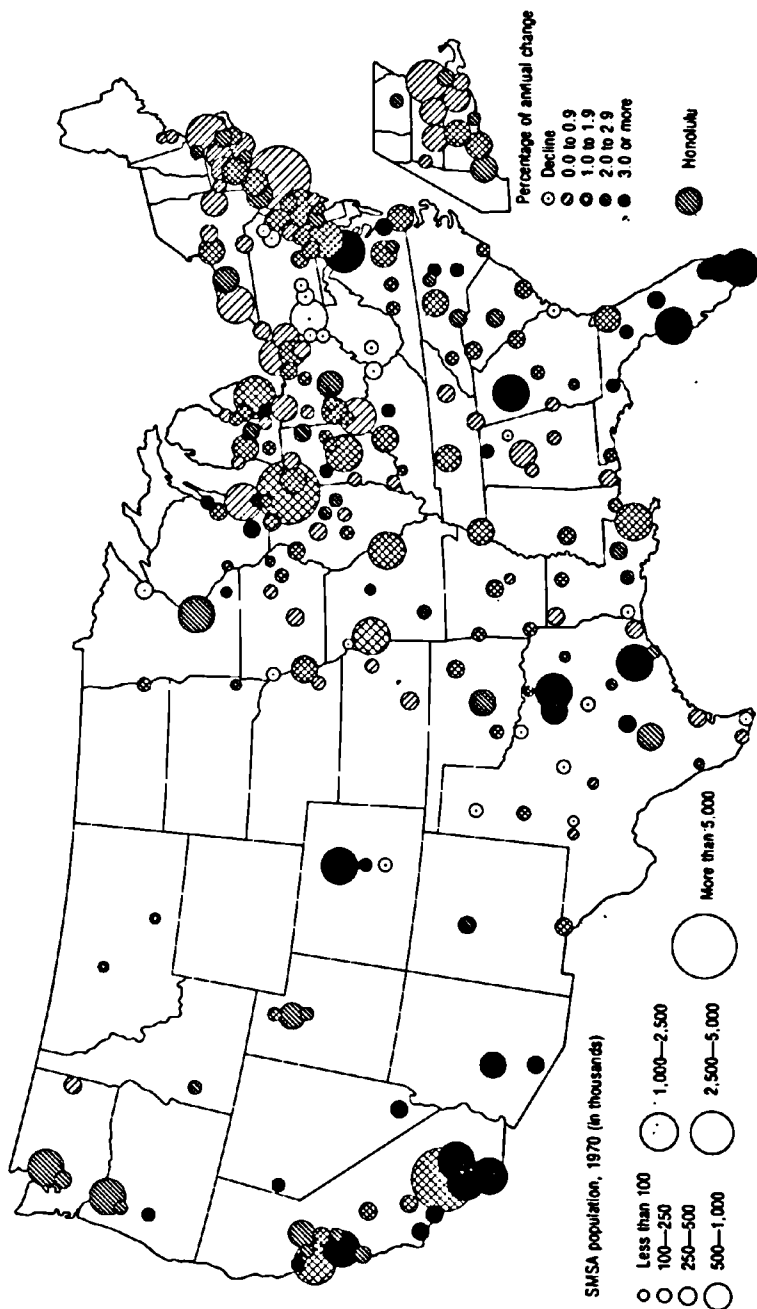


FIG. 1.—Population change in SMSAs, 1960-1970. In the 1960's only a few SMSAs registered absolute population decline. These were generally small areas in Appalachia and the Great Plains; Pittsburgh was the only area with more than 500,000 inhabitants to show absolute population decline. Although cities in the Northeast and in the North Central census regions generally grew more slowly than the national average, many cities in these regions grew by more than 1.0 percent per year in the 1960's. Compiled from data in Census of Population: 1960, less four footnotes, vol. 1, Table 1.

POPULATION CHANGE IN SMSAs, 1970-1974

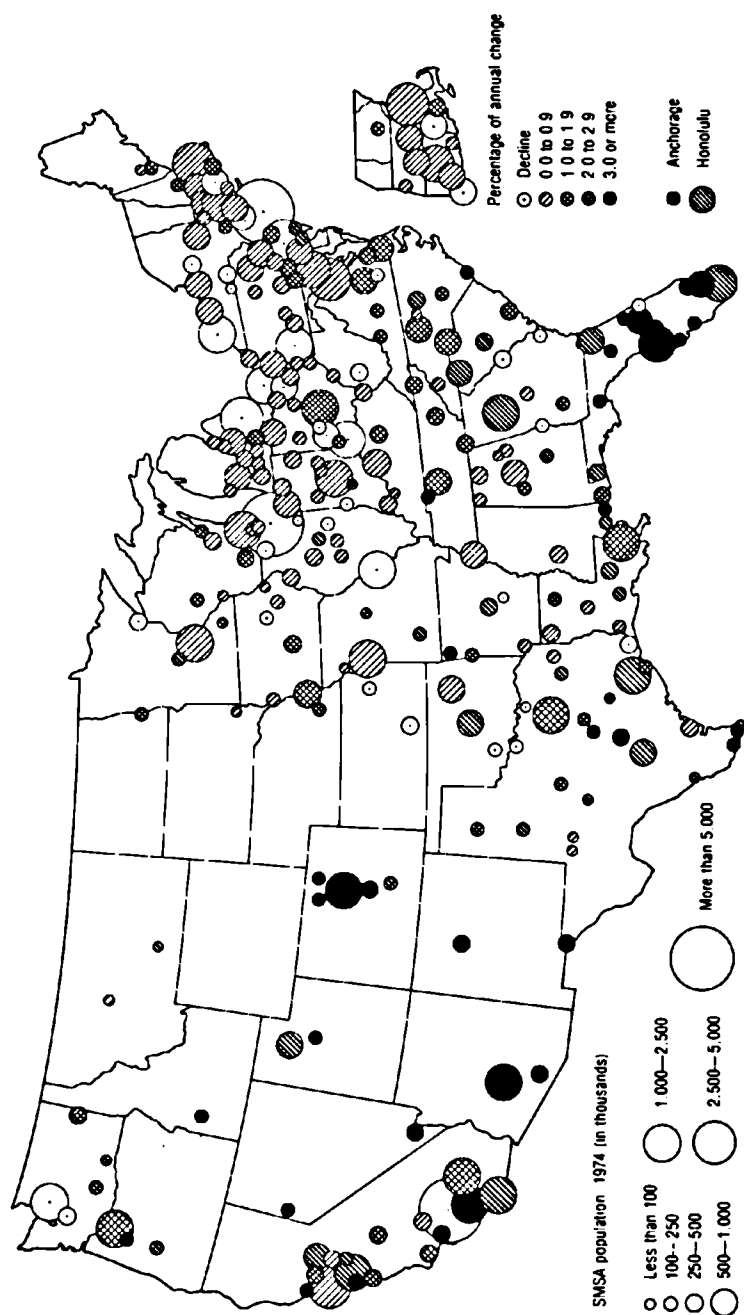


FIG. 2.—Population Change in SMSAs, 1970-1974. Overall metropolitan population growth was only half as rapid in the early 1970's as it was in the 1960's. Fourteen SMSAs with more than 500,000 inhabitants showed an absolute population loss in the 1970-1974 period. A few SMSAs in Texas, along the Gulf of Mexico, and in the Rocky Mountain states showed more rapid growth than in the 1960's. SMSAs in the Northeast and North Central regions reached an overall stability of population. The differences in growth rates between the 1960's (Fig. 1) and the 1970's are a result of much lower rates of natural population increase and a reversal of net migration gains from SMSAs to nonmetropolitan areas. Compiled from data in Estimates of the Population Areas [see text footnote 43].

19.4 in 1965 and to 14.9 in 1974, while death rates remained virtually unchanged (Fig. 4). This decline in fertility has produced a decline in the intrinsic rate of natural increase from +12.1 percent per decade in 1965 to -5.0 percent in 1974.⁷ Only the demographic momentum of the post-World War II baby boom and net in-migration, both legal and illegal, from foreign countries have maintained even the modest rate of national population increase.

By 1973, almost 70 percent of all American couples were using some form of birth control, with 25.1 percent using pills, 16.4 percent using sterilization, and 28.2 percent using other means. Of the 30 percent of couples not using contraception, most were infertile as a result of pregnancy or natural sterility.⁸ Another factor that appears to have led to a substantial decline in birthrates is the legalization of abortion, first in New York in 1970 and then in the nation in 1973.⁹ By 1974 there were 283 legal abortions for every 1,000 live births in the United States, and abortions actually exceeded live births in the District of Columbia.¹⁰ The decline in rates of natural increase has had an extremely significant impact on metropolitan areas, both because such areas make up about two-thirds of the total national population and because they generally have even lower rates of natural increase than the nation as a whole. Slower natural population increase is a major social and technological divide, though of a considerably different and less tangible nature than many previous changes, such as the development of the steel rail and internal combustion engine described by Borchert.

Increase in energy availability, like population, appears to have diminished, contributing to the new Slow Growth Epoch. The Ford Foundation's study of future energy availability concluded that "the continued growth of energy at rates approaching those in the past is unlikely" without massive government subsidies and unrealistically low price assumptions.¹¹ As traditional fossil fuel supplies have become less available, regional price imbalances favoring supply regions have developed. For example, electric bills for industrial use in 1976 were three or more times higher in some northern industrial states such as New York than in southern and western states such as Oklahoma or Wyoming. Many authorities believe that this price differential

1975). A particularly relevant study is George Sternlieb and James W. Hughes, eds.: *Post-Industrial America: Metropolitan Decline and Inter-Regional Job Shifts* (Center for Urban Policy Research, Rutgers Univ., New Brunswick, N.J., 1975), which contains a number of essays on slower growth and decline of cities in the northeastern United States. See also George Sternlieb and James W. Hughes: *New Regional and Metropolitan Realities of America*, *Journ. Amer. Inst. Planners*, Vol. 43, 1977, pp. 227-241. The population decline of larger industrial cities has been extensively reported in the popular press, especially the *New York Times* and *U.S. News & World Report*. For an extensive bibliography on this subject see Phillip D. Phillips: *No Growth and the Evolution of the American Metropolitan System*, *Exchange Bibliography No. 1289*, Council of Planning Librarians, Monticello, Ill., 1977.

⁷ *Statistical Abstract of the United States*, 1976, Tables 69 and 80. The intrinsic rate of natural increase is the rate that would prevail if a population were to experience, at each year of age, the birth and death rates occurring in a specified year and if these rates remained unchanged over a long period of time. See also Charles F. Westoff: *Changing Contraceptive Practices among Married Couples*, in *Toward the End of Growth: Population in America* (edited by Charles F. Westoff, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1973), pp. 19-31.

⁸ *Statistical Abstract of the United States*, 1976, Table 80.

⁹ Jean van der Tak: *Abortion, Fertility and Changing Legislation: An International Review* (Lexington Books, Lexington, Mass., 1974), pp. 36-39.

¹⁰ *Statistical Abstract of the United States*, 1976, Table 83.

¹¹ "A Time to Choose: America's Energy Future: Final Report" (Energy Policy Project of the Ford Foundation; Ballinger Publishing Co., Cambridge, Mass., 1974), pp. 43-44.

RATE OF POPULATION CHANGE FOR 1974 SMSAs 1960-1970 COMPARED WITH 1970-1974

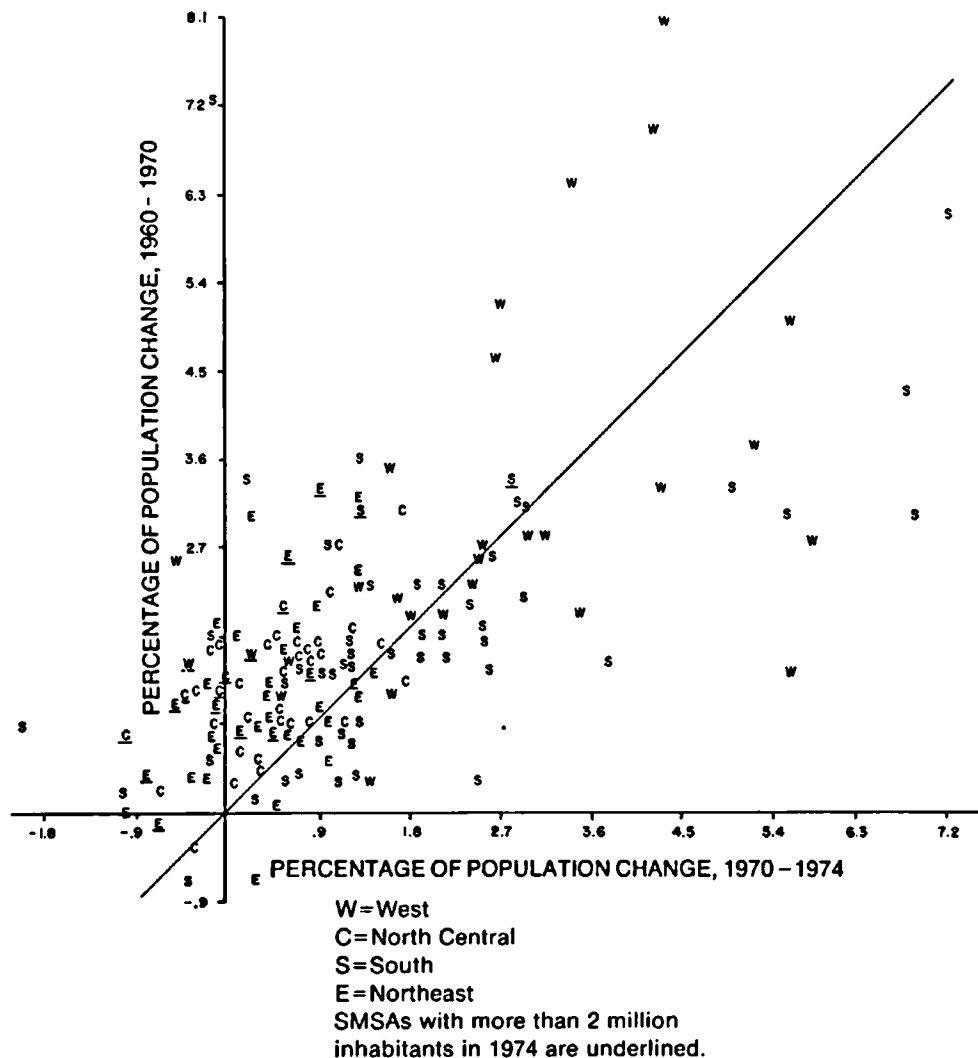


FIG. 3—Rate of population change in SMSAs with more than 200,000 inhabitants, 1960-1970 and 1970-1974. Areas above and to the left of the diagonal had less rapid population growth in the post-1970 period, while areas below and to the right of the diagonal had more rapid population growth. Regional disparities are indicated by the preponderance of SMSAs in the West and South census divisions among those with increased growth rates. Size differentials in growth rate changes are indicated by the fact that all SMSAs with more than 2 million inhabitants (underlined on the graph) grew less rapidly in the post-1970 period. Compiled from data in Census of Population: 1970 [see text footnote 4], Table 11; and Estimates of the Population of Metropolitan Areas [see text footnote 43].

BIRTH AND DEATH RATES: 1950-1974

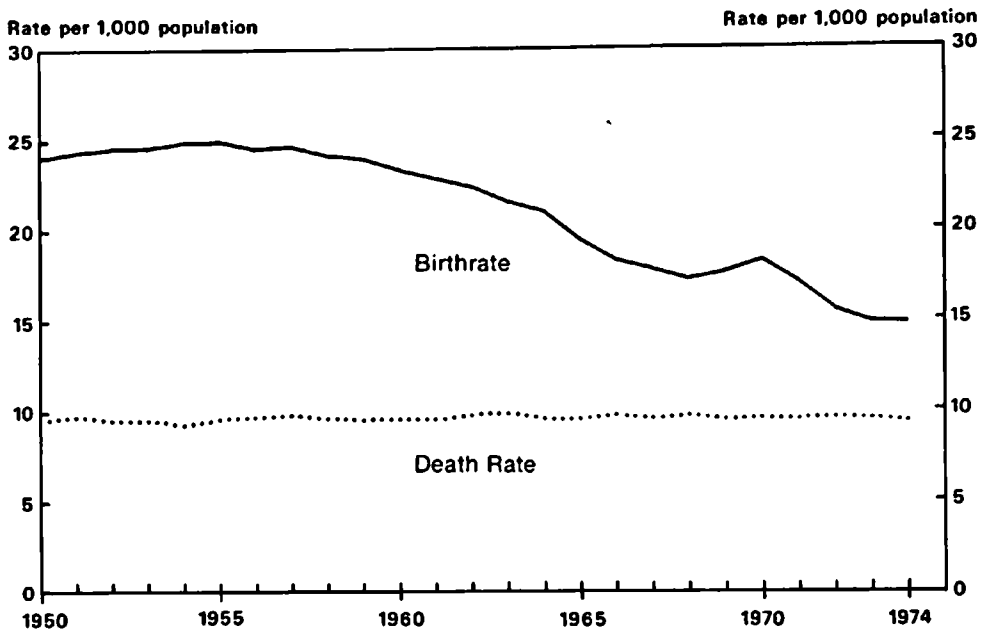


FIG. 4—Birth and death rates, 1950-1974. Although death rates remained almost stable in the United States from 1950 to 1974, birthrates declined markedly, from about 25 per 1,000 population to about 15 per 1,000 population. Net legal migration remained modest throughout the period, although several million illegal aliens, primarily from Mexico and the Caribbean countries, may have entered the country. Population has entered a slow-growth phase and would be in a no-growth condition without the demographic momentum produced by the post-World War II baby boom. Source: *Statistical Abstract of the United States*, 1976, p. 52.

is the real cause of the growth of industry and personal incomes in the Sun Belt and in western metropolitan areas.¹³

Not only has the availability of traditional coal, oil, and natural gas supplies in the Sun Belt and in rural areas placed them at a competitive advantage compared with the traditional Manufacturing Belt, but the future development of western sub-bituminous coal, oil shale, geothermal, and solar power will greatly favor these same areas. William H. Miernyk, in describing the "Decline of the Northern Perimeter," concluded that "as with most prolonged binges, the energy binge of the past quarter century is being followed by a hangover."¹⁴ This hangover will probably be most unpleasant for large northeastern industrial cities with high energy costs.

A "rural renaissance" in the United States since 1970 has also slowed the growth of the urban system.¹⁵ The post-1970 shift of net migration to nonmetropolitan areas is in

¹³ Miernyk (*op. cit.* [see footnote 6 above], p. 25) and Sternlieb and Hughes (*Post-Industrial America* [see footnote 6 above], pp. 127-132) contain discussions of the reasons for the decline of the Northeast and the growth of the Sun Belt which emphasize the role of fuel cost differences between the regions.

¹⁴ Miernyk, *op. cit.* [see footnote 6 above], p. 26.

¹⁵ A large number of books and articles discussing the increased rate of growth in nonmetropolitan areas has appeared recently. The shift of net migration trends first became evident to observers of the rural scene, who saw rapidly increasing numbers of return and new migrants from metropolitan areas. Some of the more significant works are Morrison and Wheeler (*op. cit.* [see footnote 6 above]); Calvin L. Beale: *The*

sharp contrast to historical trends. From 1790 to 1970 metropolitan America grew continually: and, with the possible exception of brief periods during the War of 1812 and the Great Depression of the 1930's, net migration was to metropolitan areas. This trend was so well ingrained that as recently as 1972 a report of the Commission on Population Growth and the American Future envisioned that most future population growth would occur in metropolitan areas.¹⁵ Yet from 1970 to 1974 nonmetropolitan areas grew at an annual rate of 1.3 percent, while metropolitan areas grew at a rate of only 0.8 percent, and three-quarters of all nonmetropolitan counties showed net in-migration.¹⁶

Nonmetropolitan growth does not appear to be simply a spillover from metropolitan areas. Net in-migration is found not only in counties adjacent to SMSAs and in counties with commuting to SMSAs but also in remote rural counties, those with no urban place (town of 2,500 inhabitants or more), and no commuting to an SMSA. Nor is nonmetropolitan growth limited to a few regions. All of the twenty-six nonmetropolitan regions defined by Calvin Beale showed population growth from 1970 to 1974, and twenty-four of these areas had net in-migration. In contrast, in the 1960's only five of these twenty-six nonmetropolitan regions had net in-migration.¹⁷

Why are people moving to nonmetropolitan areas? To some extent this movement may represent a return to earlier home areas during the recession of the early 1970's and thus be similar to rural in-migration in the 1930's. Many other factors are involved, however. Increasing Social Security and other pension benefits allow greater numbers of retirees to move not only to cities in Florida and the Southwest but also to nonmetropolitan retirement areas in the Ozarks, the Texas hill country, the Sierra Nevadas, the Upper Great Lakes, and other areas.¹⁸ Greater incomes have allowed millions of other families to build second homes and vacation hideaways, overwhelmingly in nonmetropolitan areas.¹⁹ These second homes often become retirement or other permanent homes.²⁰ Even as part-time residences, second homes spur construction industries, real estate sales, and local service economies in nonmetropolitan areas.

A good measure of the distribution of retirement and second home developments is

Revival of Population Growth in Non-Metropolitan America (ERS-605; U.S. Dept. of Agriculture, Economic Research Division, Economic Research Service, Washington, D.C., 1975); *idem*, Rural and Nonmetropolitan Trends of Significance to National Population Policy, in *Population, Distribution, and Policy* [see footnote 6 above], pp. 665-677; Glenn V. Fuguitt: Population Trends in Nonmetropolitan Cities and Villages in the United States, *ibid.*, pp. 109-126; Glenn V. Fuguitt and James J. Zuiches: Residential Preferences and Population Distribution, *Demography*, Vol. 12, 1975, pp. 491-501; Niles M. Hansen: The Future of Nonmetropolitan America: Studies in the Reversal of Rural and Small Town Population Decline (Lexington Books, Lexington, Mass., 1973); Irving Kristol: An Urban Civilization without Cities, *Horizon*, Vol. 14, Autumn, 1972, pp. 36-41; James E. Vance, Jr.: California and the Search for the Ideal, *Annals Assn. of Amer. Geogr.*, Vol. 62, 1972, pp. 185-210; and James J. Zuiches and Glenn V. Fuguitt: Residential Preferences: Implications for Population Distribution in Nonmetropolitan Areas, in *Population, Distribution, and Policy* [see footnote 6 above], pp. 617-630. For a more complete bibliography on this subject see Phillips, *No Growth* [see footnote 6 above].

¹⁵ Sarah Mills Mazie: Introduction in *Population, Distribution, and Policy* [see footnote 6 above], pp. xiv-xvi.

¹⁶ Morrison and Wheeler, *op. cit.* [see footnote 6 above], pp. 3-4.

¹⁷ *Ibid.*, p. 17.

¹⁸ *Ibid.*, pp. 21-22.

¹⁹ William K. Reilly: The Use of Land: A Citizens' Policy Guide to Urban Growth (Thomas Y. Crowell Co., New York, 1973), pp. 263-293.

²⁰ Marion Clawson: Suburban Land Conversion in the United States: An Economic and Governmental Process (Resources for the Future, Baltimore, 1971), p. 54.

provided by the distribution of land sales developments sold on an interstate basis and reported to the United States Department of Housing and Urban Development.²¹ The states with the largest numbers of developments are rural amenity and Sun Belt states, notably Florida and Arizona. Large numbers of developments are also found in the Ozark Mountain states (Arkansas and Missouri), in the southern Appalachians (North Carolina and Virginia), and in New England (especially New Hampshire). The Great Plains states and the urban-industrial states of the Northeast are conspicuous because of the small number of developments they have, especially in relation to their population. Although some of these interstate land sales developments are in metropolitan areas, many are in nonmetropolitan areas, and their location in sunshine, coastline, and topographic amenity areas clearly defines the type of area that Americans seek out in looking for the "good life."

Perhaps the most significant change affecting the metropolitan-nonmetropolitan migration balance has been the intensification and implementation of a "rural mystique." While many Americans increasingly see the city as being crowded, dangerous, and dirty, the countryside and small towns are viewed as open, clean, and safe. This may be contrasted to the views of the early twentieth century, when small-town America was seen as vacuous—a "Gopher Prairie," where, in the words of Sinclair Lewis, "dullness was made god."²² Guidebooks to "safe" small towns far from the corrupting influences of metropolitan areas have become best sellers.²³ Telephones and the electronic media have broken down much of the isolation and provinciality of rural areas, while better transportation has made them more accessible. This has allowed increasing numbers of persons to enjoy the benefits of rural environments without their traditional shortcomings. Not only have retirees, vacationers, and the independently wealthy been attracted to rural areas, but small industries and artisans have been attracted as well, as have an undetermined number of footloose former metropolitan residents who have moved to small towns and rural areas to open general stores, gift shops, weekly newspapers, and the like.²⁴

Recent out-migration from metropolitan areas may represent the beginning of what has been called a "post-city" age based on widely available, inexpensive electronic communications and data processing.²⁵ Americans, unlike Europeans, have traditionally viewed cities not as cultural centers but as economic entities designed to facilitate communications and to pool labor.²⁶ Thus, "no Frenchman can imagine France without Paris, but it is not so hard to imagine the United States without New York—millions of Americans engage in this fantasy every day."²⁷ Viewing the city in economic, and perhaps even social, terms, Ronald Abler could ask, "with complete time- and cost-space convergence, why even have cities?"²⁸

²¹ 1975 *Yearbook*, U.S. Dept. of Housing and Urban Development, Washington, D.C., 1976, p. 213 and table 1.

²² Peirce F. Lewis: *Small Town in Pennsylvania*, *Annals Assn. of Amer. Geogr.*, Vol. 62, 1972, pp. 323-351.

²³ David and Holly Frank: *Safe Places East of the Mississippi* (Warner Paperbacks, New York, 1973); and *idem*, *Safe Places West of the Mississippi* (Warner Paperbacks, New York, 1973).

²⁴ Vance, *op. cit.* [see footnote 14 above], pp. 190-193 and 207-210.

²⁵ Kristol, *op. cit.* [see footnote 14 above], p. 36; and Ronald Abler: *Effects of Space-Adjusting Technologies on the Human Geography of the Future*, in *Human Geography in a Shrinking World*, *op. cit.* [see footnote 5 above], pp. 35-56, reference on pp. 48-51.

²⁶ Jerome P. Pickard: *U.S. Metropolitan Growth and Expansion, 1970-2000, with Population Projections*, in *Population, Distribution, and Policy* [see footnote 6 above], pp. 127-182.

²⁷ Kristol, *op. cit.* [see footnote 14 above], p. 37.

²⁸ Abler, *op. cit.* [see footnote 23 above], p. 35.

The era of low-cost, widely available communications has been given many names by authorities as wide-ranging as Alvin Toffler and Zbigniew Brzezinski. Among these are postindustrialism, the superindustrial age, the age of discontinuity, the tectronic era, the communications era, and the electronic social transformation.²⁹ Whatever its name, authorities agree that one of the chief attributes of this coming era is that "improvements in transportation and communications have eroded the functions of geographic space."³⁰ Furthermore, "in a 'communications affluent' society . . . many of the pressures for urbanization may be reversed,"³¹ and "the technological means for spreading industrial and commercial activities to rural areas are [already] available in abundance."³²

The late 1960's and early 1970's have seen two major trends in communications technologies that have reduced urban centrality. The first has been the merger of the computer and telecommunications systems to transfer information and the development of time-sharing techniques "which bring the capabilities of computers and the information in data banks to millions of locations."³³ The second trend has been in the increasing capacity and wider diffusion of telecommunications. By the early 1970's, for instance, it was possible to transmit 108,000 simultaneous voice channels through one coaxial cable.

Communications scientists predict that in the next few decades the use of presently available communications techniques will increase vastly and that two-way cable transmission of television, facsimile mail and newspapers, and information retrieval between private homes and data banks will also become commonplace.³⁴ As a result, office files, library information, and educational data will be readily and widely accessible, allowing people to work and learn at home and to live almost anywhere they wish.³⁵ Whether or not future developments live up to the expectations of communications scientists, the move to substitute communications for transportation seems already to be under way. Between 1960 and 1973 the number of intercity ton miles of freight hauled grew by 68 percent and intercity passenger miles grew by 73 percent, while telephone conversations grew by 102 percent and cable-television subscribers by an amazing 1,023 percent.³⁶ The rapid growth of cable television is indicated by an Atlanta television station, which is now received in forty-four states via satellite-cable systems.

The form of settlement in a high communication "post-city" age remains in doubt. Jerome Pickard foresees an "urban splatter" along interstate highway corridors throughout the nation.³⁷ Brian Berry, on the other hand, sees a "new frontier" for

²⁹ Mark L. Hinshaw: *Wiring Megalopolis: Two Scenarios*, in *Communications Technology and Social Policy: Understanding the New "Cultural Revolution"* (edited by George Gerbner, Larry P. Gross, and William H. Melody; John Wiley & Sons, New York, 1973), pp. 305-318.

³⁰ Melvin M. Webber: *Urbanization and Communications*, *ibid.*, pp. 293-304, reference on p. 295.

³¹ Dieter Kimbel: *An Assessment of the Computer Telecommunications Network in Europe, Japan and North America*, *ibid.*, pp. 147-163, reference on p. 149.

³² Dennis Gabor: *Social Control Through Communications*, *ibid.*, pp. 83-93, reference on p. 87.

³³ Kimbel, *op. cit.* [see footnote 31 above], p. 147.

³⁴ *Ibid.*, pp. 155-157.

³⁵ Harold Sackman: *Computers, System Science and Evolving Society: The Challenge of Man-Machine Digital Systems* (John Wiley & Sons, New York, 1967); John G. Kemeny: *Man and the Computer* (Charles Scribner's Sons, New York, 1972); and Abler, *op. cit.* [see footnote 25 above], pp. 51-53.

³⁶ *Statistical Abstract of the United States, 1976*, Tables 877, 970, and 971.

³⁷ Pickard, *op. cit.* [see footnote 26 above].

those of wealth in nonurban "rimland" environments of hills, water, and forests. He urges that we face this fact and "speed abandonment" of traditional cities so that we may achieve "an urban civilization without cities."³⁸ Others, however, do not foresee the end of the city and castigate those who do. Economist Wilbur Thompson, responding to Berry's predictions, said, "I believe that they [the cities] will come back for a reason that a good geographer like Brian Berry should appreciate: they have the best local site. Unfortunately, geographers do not study landscapes any more. They all have elaborate data processing equipment and run census data endlessly through their machines."³⁹ Whether we enter Berry's "post-city" age or Thompson's age of urban "comeback," it appears likely that improved communications technology will favor greatly lowered population densities and will allow realignment of development to high-amenity natural environments outside the bounds of traditional metropolitan areas.

SLOW GROWTH AND THE CHARACTER OF THE METROPOLITAN SYSTEM

Slower overall growth will cause the growth of regions and metropolitan centers to increasingly approach a zero-sum game.⁴⁰ Traditionally, growth and decline have been measured relative to the elastic yardstick of ever-increasing national population and economic production. "Declining" regions and cities almost always grew in absolute population but at a slower rate than the nation as a whole; as a result they represented progressively declining proportions of the national population and economic output. Thus, for example, though Louisville, Kentucky, declined one rank between 1870 and 1920 in Borchert's comparative ranking of metropolitan areas, the absolute population of the city increased from 100,753 in 1870 to 234,891 in 1920.⁴¹ Slower growth implies a less elastic yardstick, one in which relative decline will more frequently mean absolute decline as well.

The effects of slower growth and a near-zero-sum game have become evident in recent years, first in manufacturing employment and more recently in total population. From 1967 to 1973 the South gained 802,000 jobs in manufacturing. The total growth of manufacturing employment in the United States during this period was only 644,000, however. As a result, the Northeast, and especially its metropolitan centers, became an absolute as well as a relative loser, with a loss of 482,000 manufacturing jobs.⁴² Since 1970 interregional and intermetropolitan population change has also become more of a zero-sum game. Between 1970 and 1974, according to census estimates, the South showed a 7.7 percent population increase and the West had a 6.2 percent increase. This balanced against a meager 1.0 increase in the North Central states and a 0.1 percent decline in the Northeast. These regional rates of population change reflect almost entirely the changes of metropolitan growth rates within the regions. At the SMSA level, thirteen metropolitan areas showed population increases of more than 20 percent from 1970 to 1974, but this was balanced by forty-two

³⁸ Berry, *op. cit.* [see footnote 6 above], p. 183.

³⁹ Wilbur Thompson: Economic Processes and Employment Problems in Declining Metropolitan Areas, in *Post-Industrial America* [see footnote 6 above], pp. 187-196; reference on p. 196.

⁴⁰ Alonso, *op. cit.* [see footnote 6 above].

⁴¹ Borchert, *op. cit.* [see footnote 1 above], p. 318.

⁴² "Why Biggest Strip City Lags in Growth—and Power," *U.S. News & World Report*, Feb. 2, 1976, pp. 30-32.

metropolitan areas, including many of the most populous, which showed absolute decline (Figs. 1 and 2).⁴³

The reduced rate of natural population increase in the 1970's has been largely responsible for the radical increase in the number of SMSAs showing absolute population decline. Interregional and intermetropolitan economic shifts have always produced out-migration for some areas, but this has been more than balanced by a "cushion" of natural increase. In the 1960's natural increase was more than 1.6 percent per year for a large number of SMSAs and was less than 1.0 percent per year almost exclusively in cities of the Northeast and Florida with aged population structures (Fig. 5). By the 1970 to 1974 period, rates of population increase had slowed dramatically, not only for the nation as a whole but also in almost every SMSA (Fig. 6). Only a few SMSAs of the Rio Grande Valley and in Mormon Utah maintained natural increase rates of more than 1.6 percent per year, and the vast majority of SMSAs had rates of increase of less than 1.0 percent per year. A good example of the effect of declining rates of natural increase on population change is provided by the Chicago SMSA, where the decline in natural increase made the difference between the observed 0.1 percent population decrease from 1970 to 1974 and the 1.6 percent increase that would have occurred from 1970 to 1974 if the natural increase rates of the 1960's had prevailed.⁴⁴

Slow growth and a near-zero-sum game in the metropolitan system will have a significant impact on interregional and intermetropolitan competition. Because absolute as well as relative losses will occur, competition for growth, especially in jobs, is likely to become more vicious. Recent "pirating" expeditions from the South and New England for New York firms is undoubtedly only a portent of more intense competition in the future. In efforts to woo industry and business many areas will be tempted to follow the same strategy as slowly growing cities in the past—to accept lower wages, polluting industries, and the exploitation of human and natural resources by nonlocal corporations. Rather than being the boon envisioned by environmentalists, slow growth and no growth may be a short-term environmental nightmare.⁴⁵

Losers in the competition for corporate growth (and for governmental facilities as well) will increasingly demand compensatory aid from federal and state governments to prevent the absolute decline of their areas. As general population growth slows it will become increasingly difficult to prevent some areas from declining if other areas are allowed to grow. Thus long-term forces toward a conservative welfare economy, in which efficiency is sacrificed to regional stability, will be set in motion. Control of growth and decline, if it occurs, could significantly diminish individual freedom of choice to live in preferred environments as inducements are established to artificially maintain the population of older manufacturing cities and regions at the expense of the Sun Belt.

Slower growth will also have a tremendous impact on the general economic and social character of metropolitan areas. Kenneth Boulding characterized the relationship between rates of population increase and employment hierarchies as follows:

⁴³ "Estimates of the Population of Metropolitan Areas, 1973 and 1974, and Components of Change Since 1970" (U.S. Bur. of the Census, Washington, D.C., 1976).

⁴⁴ "Census of Population: 1970. General Demographic Trends for Metropolitan Areas" (U.S. Bur. of the Census, Washington, D.C., 1971), Table 11 and calculations by the authors.

⁴⁵ Rust, *op. cit.* [see footnote 6 above], p. 29.

NATURAL POPULATION INCREASE IN SMSAs, 1960-1970

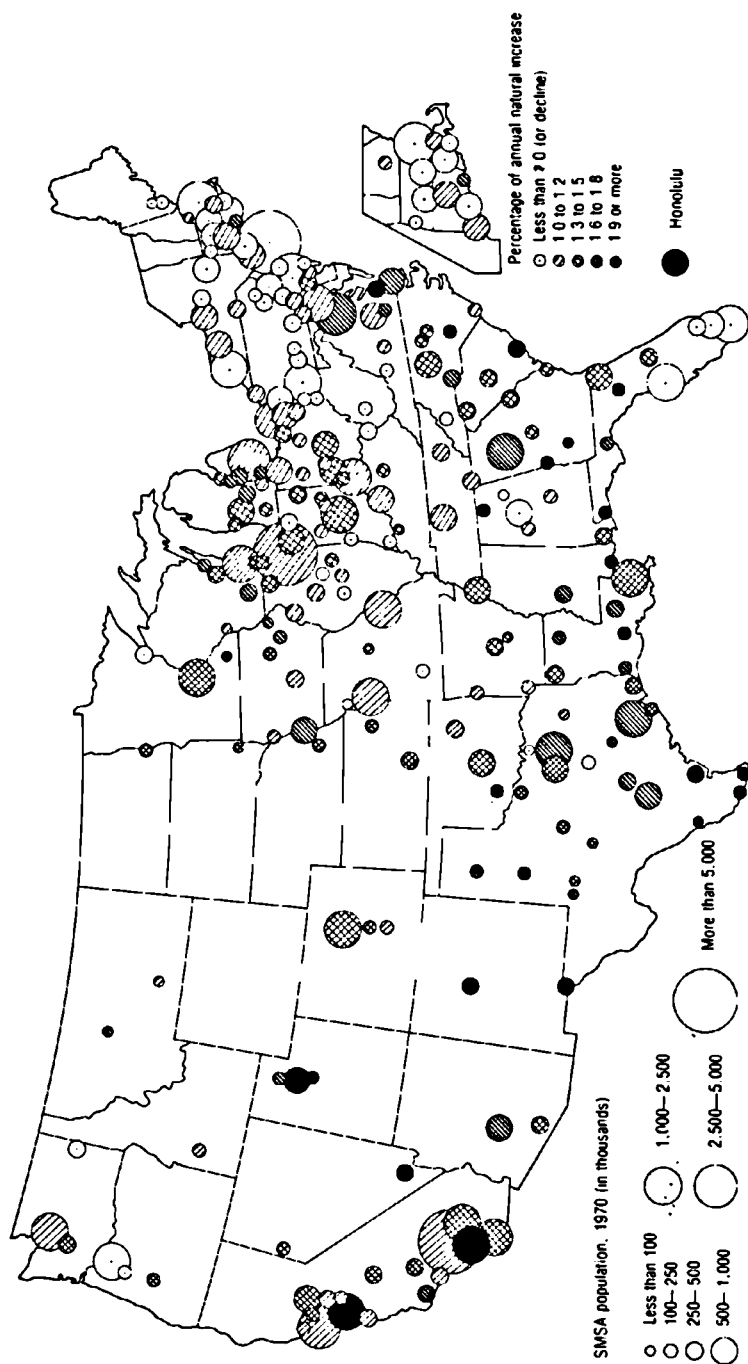


FIG. 5—Natural increase, 1960-1970. In the 1960's almost all SMSAs had a rate of natural population increase greater than 1.0 percent per year. Exceptions were cities with older age structures, including manufacturing centers in the Northeast and in the North Central census regions and retirement centers in Florida. Many SMSAs with young age structures had increase rates of more than 1.6 percent per year. Compiled from data in the Census of Population: 1970 [see text footnote 44], Table 11.

NATURAL POPULATION INCREASE IN SMSAs, 1970-1974

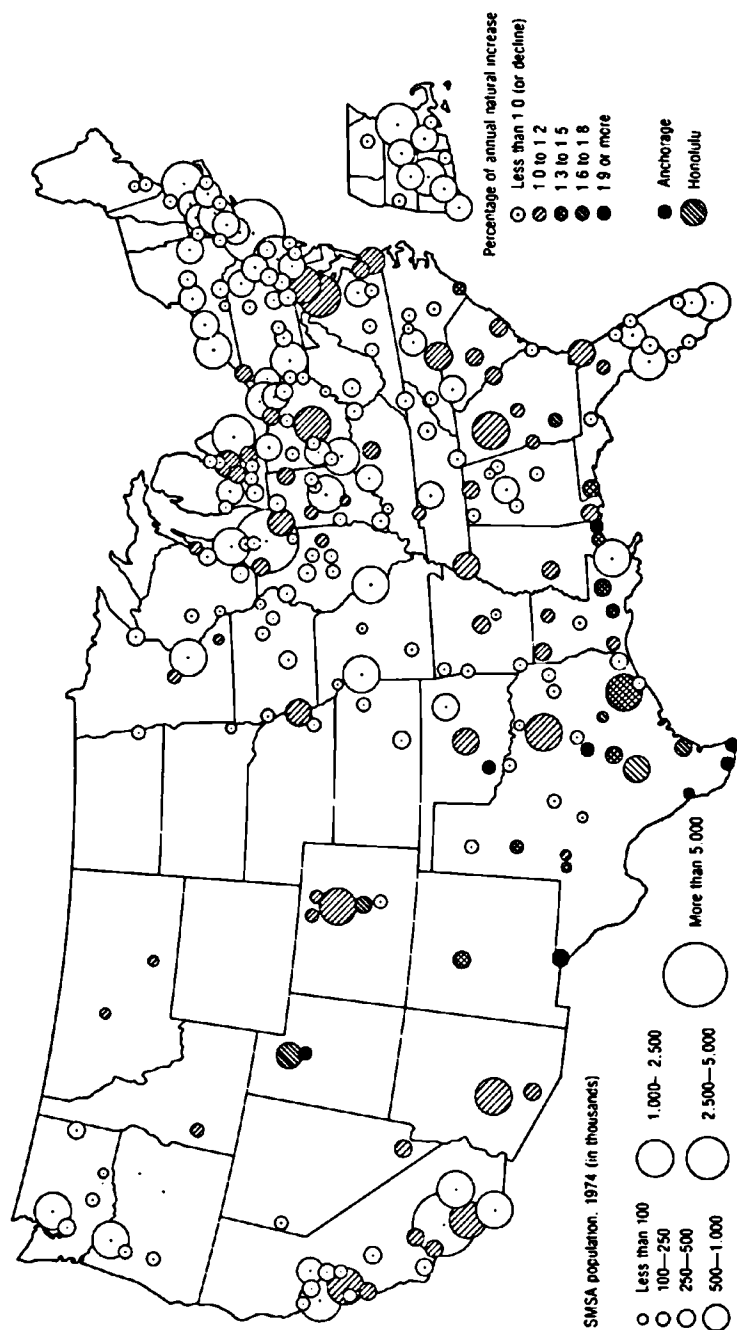


FIG. 6. Natural increase, 1970-1974. Declines in natural increase rates since the 1960's are dramatic and nearly universal. The majority of SMSAs now have growth rates below 1.0 percent per year. The exceptions are cities in Texas and Louisiana with large Catholic populations and cities in Utah with large Mormon populations. Source: Estimates of the Population of Metropolitan Areas [see text footnote 43].

PERCENTAGE OF DWELLINGS IN SMSAs BUILT BEFORE 1940

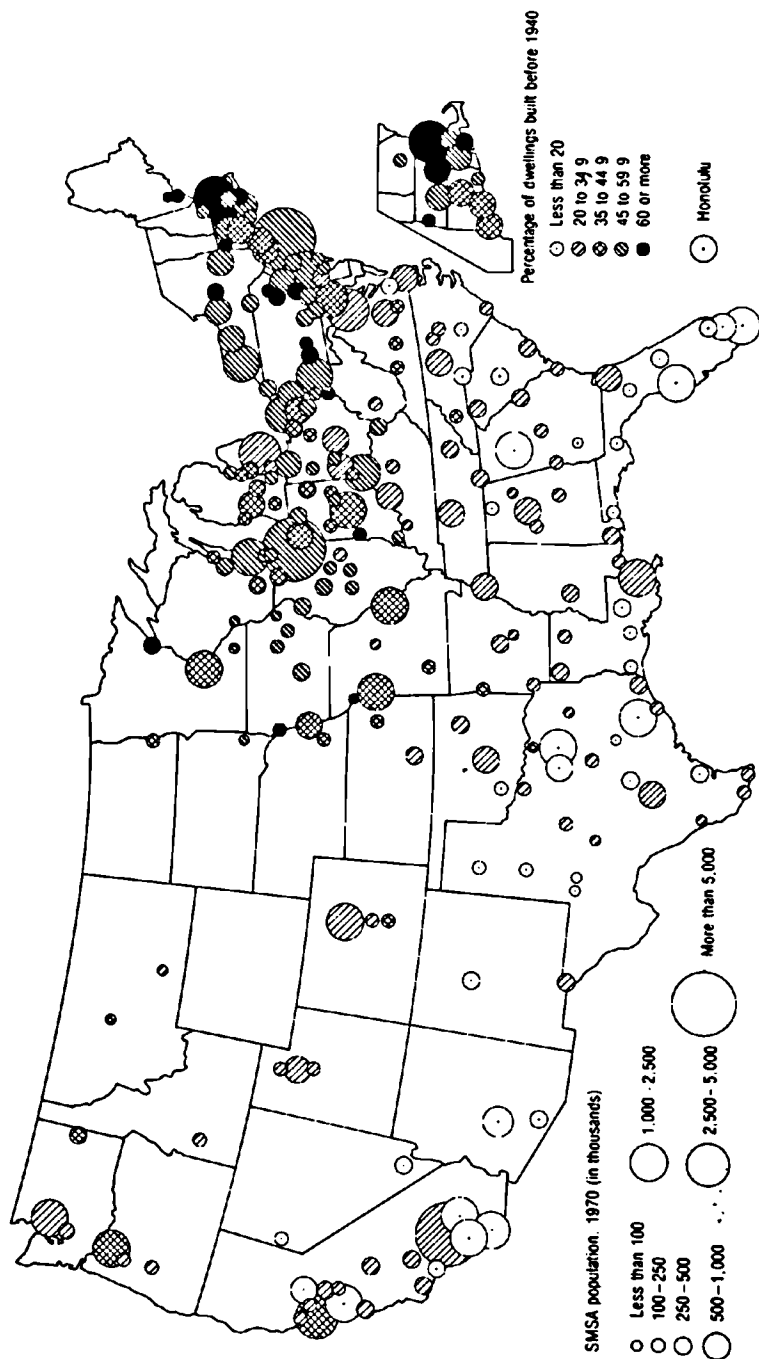


FIG. 7 Percentage of dwellings in SMSAs built before 1940. The age of housing stock provides a dramatic illustration of the contrast between the Sun Belt and the Manufacturing Belt. Areas with predominantly pre-1940 housing have large sections that meet Borchert's definition of technological obsolescence and qualify as "inhabited ruins" (Borchert, *op. cit.* [see text footnote 1], p. 339). Rehabilitation, maintenance, and renovation are much more important in cities with large supplies of older housing. As national growth rates slow, many more cities will have predominantly older housing stocks and will become predominantly rehabilitation-oriented. Source: Census of Population: 1970. Vol. 1, Characteristics of the Population; Part 1, United States Summary.

Hierarchies tend to have a triangular structure, with large numbers of people in lower levels and diminishing numbers in each echelon as one goes toward the top. If the age distribution is likewise triangular, then an individual who does not die first has a good chance of rising in the social hierarchy: that is, if he doesn't go out, he goes up. With the rectangular age distribution [found in no growth areas], however, a good many individuals go neither out nor up. Then the question of what to do with older people who do not rise in the status or income hierarchies of society becomes very acute.⁴⁶

Or, as Wilbur Thompson pithily observed, "Young professionals out West are pushing for no-growth so that the wait at the ski line is *shorter*. They will come to understand that under no-growth, the wait for promotion at the office is going to be *longer*—a hell of a lot longer."⁴⁷

The experience of some of America's few previous no-growth cities, described by Edgar Rust in "No Growth: Impact on Metropolitan Areas," fits this pattern. Cities such as Terre Haute, Indiana, have few young persons entering the job market because of heavy out-migration. As a result, corporate age profiles become top-heavy with executives who have remained in the same jobs for long periods of time, producing low levels of entrepreneurship and limited capacity for innovation. Non-local communications fields of such cities also tend to contract. Perhaps the most pernicious aspect of no growth that Rust describes is the development of a deeply ingrained attitude of "risk-avoidance" by all institutions, including banks, churches, utility companies, and government agencies. These institutions learn that risk-takers prosper in a growing area but perish in a stable area.⁴⁸ If American cities develop rectangular age profiles and reasonably stable populations as a result of lower rates of natural increase and net out-migration to nonmetropolitan areas, risk-avoidance may become the dominant style of management and aggressive entrepreneurship and innovation may become less common.

Boulding is particularly gloomy in portraying the nature of an economy that is not growing. He suggests that a rapidly growing system is "cheerful," because the poor can become richer without the rich becoming poorer. A stable metropolitan area, in economic or population terms, generates more conflict and more often generates exploitation of people rather than resources by "mafia-type" social organizations.⁴⁹ Rust, in his investigation of previously nongrowing metropolitan areas, found greater inequalities of education, welfare, and public health there than in growing areas.⁵⁰ Thus it appears that no-growth metropolitan areas will have a strong tendency to develop high levels of social inequality and exploitation.

Slower growth also implies an increasingly aged housing stock and infrastructure. Great regional disparities already exist in age of housing (Fig. 7). In almost no SMSAs of the Northeast and North Central regions was less than 35 percent of the 1970 housing stock built before 1940, and in many of these SMSAs more than 60 percent of the housing was built before 1940. In contrast, in only a handful of cities in the South and West does more than 35 percent of the housing stock predate 1940, and in many cities pre-1940 housing is less than 20 percent of the total supply. Declining

⁴⁶ Kenneth Boulding: *The Shadow of the Stationary State*, *Daedalus*, Vol. 102, No. 4, pp. 89-101; reference on p. 94.

⁴⁷ Thompson, *op. cit.* [see footnote 39 above], p. 195.

⁴⁸ Rust, *op. cit.* [see footnote 6 above], pp. 179-180.

⁴⁹ Boulding, *op. cit.* [see footnote 46 above], p. 95.

⁵⁰ Rust, *op. cit.* [see footnote 6 above], pp. 183-185.

national population growth rates will produce fewer new families and less demand for housing. Employment in construction, both for residential and commercial purposes, will decline, with severe economic impact. Moreover, much of the remaining construction will be not in new structures but in the repair, renovation, and restoration of existing structures. It is sobering to realize that the "boom" in the Sun Belt is only comparative, that the overall growth rate of metropolitan areas in the South in the 1970's is lower than the growth rates of metropolitan areas in the North Central states in the 1950's. By the year 2000 the housing stock of southern cities is likely to contain as high a proportion of housing more than forty years old as northern cities had in 1970.

Slower growth will have some positive effects, however. In his study of previous no-growth and slow-growth cities, Rust found four major benefits of slower growth. Housing tends to be less expensive, more plentiful, and more often owner-occupied. Crime rates are markedly lower, even when the older age structure of nongrowth cities is accounted for. Stress diseases show a lower incidence in the apparently more placid and stress-free environment of nongrowing cities. Finally, nongrowth cities tend to exhibit stronger family, church, and ethnic ties and to more effectively transmit values from generation to generation. Rust concluded that "an overriding public objective . . . should be to protect, enhance, and capitalize on the benefits of slow growth."⁶¹ Edgar Hoover speculates that population stabilization can have many favorable impacts on metropolitan areas, including less demand for improved urban transport, slower flight of upper-income whites to the suburbs, less pressure on the environment and enhanced possibilities for housing rehabilitation and renovation, reduced racial strife, and improved school quality.⁶² Likewise, Thompson suggests that central cities will have a greater ability to rebuild and renovate if they are freed of the need to house rapidly increasing populations of poor immigrants from rural areas.⁶³

AN UNCERTAIN PROSPECT

The nature of future slow-growth and no-growth cities is difficult to predict with certainty. Unlike no-growth cities of the past, which were islands of decline and out-migration in a growing system, no-growth cities of the future will be more similar to the system as a whole. The massive out-migration of the young that has characterized previous nongrowing cities such as Terre Haute, Indiana, and St. Joseph, Missouri, will not be necessary to maintain slow or no population growth as rates of natural increase decline. Nathan Glaser pointed out that Vienna and Detroit are similar in size and that both have stable or slightly declining populations. There is a tremendous difference in the attitudes of the people in these two cities, however. Whereas population stability and physical decay are synonymous in Detroit, the citizens of Vienna can accept and applaud population stability or decline.⁶⁴ Overcoming Americans' traditional love of newness and belief that growth is good may be the most difficult challenge of slower growth. Most chambers of commerce and civic organiza-

⁶¹ *Ibid.*, pp. 221-222; also pp. 169-185.

⁶² Hoover, *op. cit.* [see footnote 6 above], p. 541.

⁶³ Thompson, *op. cit.* [see footnote 39 above], p. 192.

⁶⁴ Nathan Glaser: Social and Political Ramifications of Metropolitan Decline, in *Post-Industrial America* [see footnote 6 above], pp. 235-244, reference on pp. 237-238.

tions still actively seek population and economic growth for their area. Even those who call for no growth for the population of their own city or town rarely see it in the context of no growth in population, energy, or jobs for their entire region or the metropolitan system as a whole.⁵⁶

The embryonic Slow Growth Epoch described here is the product of many new societal trends. Overall, these trends are now poorly defined and understood, and many of them, if followed for a prolonged period in the future, are contradictory and incompatible. The decline of the Manufacturing Belt and the growth of the Sun Belt can be documented, but how long these trends can continue before demands for equity in growth from declining areas become a strong political force is not clear. Already, groups such as the Northeast-Midwest Economic Advancement Coalition have called for "a major economic stimulus of the sort only the federal government has the resources to provide. In other words, it is time for Congress and the executive branch to consider a Tennessee Valley Authority for the Northeast and Midwest."⁵⁶ Counter, pro-Sun Belt groups, such as the Southern Growth Policies Board, have been formed and claim that the South still needs help because "the South still lags behind the nation in absolute terms."⁵⁷ Claims and counterclaims between these groups led one observer to deplore the "U.S. North-South 'poor mouth' contest" in which both regions claim to be poorer and more beleaguered.⁵⁸

The "post-city" age foreseen by many may not be compatible with higher costs for, and shortages of, energy. Although innovations in telecommunications allow decisions to be made in nontraditional rural settings, they cannot make the energy consumption levels of exurbanites as low as those of urbanites. Exurban residents consume more energy for transportation to purchase goods, for recreation, and for provision of vital services. Those who have chosen to live in exurban villages and in mountain hideaway homes will be faced with difficult if not impossible choices if energy prices continue to rise or if rationing of gasoline and other energy sources becomes widespread. These choices will be especially difficult for lower- and moderate-income households, which make up the bulk of the exurban population.⁵⁹ High energy use by exurbanites may also prompt government regulation of this type of development, severely curtailing the "post-city" age.

The nature of the Slow Growth Epoch that America appears to have entered will depend largely on compromises among the various contradictory forces that have produced it. Recently reversed trends in birthrates, metropolitan-nonmetropolitan migration, and energy availability may change again in unpredictable directions. Not only will trends clash, but society may not choose to follow new technologies to the fullest extent possible. The role of nontechnological ethical and moral constraints are exemplified by recent decisions of the U.S. Supreme Court limiting federal support of abortion to welfare mothers and the continuing strong "right-to-life" movement to end all abortions. Further evidence of ethical and practical limitations on technology is indicated by the fact that a computerized crime information network proposed by

⁵⁶ "No for No-Growth: Petaluma, California Case," *Time*, Feb. 18, 1974, pp. 84-85.

⁵⁷ Michael J. Harrington and Frank Horton: Time To Help Out the North, *Chicago Daily News*, July 7, 1977.

⁵⁸ "South Taking Funds Fight More Seriously," *New York Times*, Dec. 18, 1977.

⁵⁹ "The North-South 'Poor Mouth' Contest," *New York Times*, Jan. 14, 1978.

⁶⁰ Phillip D. Phillips: Exurban Commuters in the Kentucky Bluegrass Region (Center for Real Estate and Land Use Analysis, Lexington, Ky., 1976).

the Federal Bureau of Investigation in the late 1960's has not been instituted in the late 1970's not because of practical problems in collecting data and designing the system but because of fears that it would infringe on civil liberties.⁶⁰

What will the ultimate impact of the Slow Growth Epoch be on the American metropolitan system and the internal structure of American cities? To what extent do the slow-growth trends described here apply to other advanced industrial nations as well as the United States? Discussion and exploration of these questions are vital if we are to understand the nature of changes occurring in our cities and to develop policy alternatives to deal with these changes; but answers will surely and easily be given only in hindsight, probably several decades hence.

⁶⁰ Deborah Shapley: Central Crime Computer Project Draws Mixed Reviews, *Science*, Vol. 197, No. 4299, 1977, pp. 138-141.

PERCEPTUAL REGIONS IN TEXAS*

TERRY G. JORDAN

PERCEPTUAL or vernacular regions are those perceived to exist by their inhabitants and other members of the population at large. They exist as part of popular or folk culture. Rather than being the intellectual creation of the professional geographer, the vernacular region is the product of the spatial perception of average people. Rather than being based on carefully chosen, quantifiable criteria, such regions are composites of the mental maps of the population.

Geographers in the United States have recognized the existence of perceptual regions for some years, but few have attempted to study them. Pioneer works by Joseph W. Brownell and Gary S. Dunbar appeared in the early 1960's.¹ Seemingly these have had little impact; and even the infusion of behavioral psychology, which yielded such a rich and abundant harvest of perception studies in American geography, has so far produced only a handful of investigations of perceptual regions.²

In an effort to map and analyze the major vernacular regions of Texas, I gathered data by means of a questionnaire administered to 3,860 Texans in the spring of 1977. Questionnaires were distributed in classrooms at thirty colleges and universities across Texas (Fig. 1). Under controlled conditions designed to prevent prior discussion or suggestion of "correct" answers, respondents were asked to reply in writing to questions concerning vernacular regions as related to their home county.³ A fairly good distribution of counties was obtained in this manner. To cover most of the scattering of rural counties for which no responses were received, questionnaires were distributed to some nonstudent residents—county farm agents, postmasters, newspaper editors, and the like. The large majority of respondents, however, were college students, and as a result most were young, above average in education, and wealthier than the norm. The sample is thus biased in several respects and my findings should be regarded with some caution. I do feel, however, that the regional patterns shown are basically accurate.

* This study was funded by the Faculty Research Committee of North Texas State University, Grant No. 34287, 1976-1977. I am also grateful to the thirty-four geographers, sociologists, folklorists, and historians at colleges and universities around Texas who administered the questionnaire to their students.

¹ Joseph Brownell: *The Cultural Midwest*, *Journ. Geogr.*, Vol. 59, 1960, pp. 81-85; and Gary S. Dunbar: *Popular Regions of Virginia*, *Univ. of Virginia News Letter*, Vol. 38, No. 3, 1961, pp. 9-12.

² Notable among these few are Ruth Feser Hale's unpublished doctoral dissertation: *A Map of Vernacular Regions in America* (Dept. of Geography, Univ. of Minnesota, Minneapolis, 1971). A portion of Dr. Hale's map was published in E. Cotton Mather: *The American Great Plains*, *Annals Assn. of Amer. Geogr.*, Vol. 62, 1972, p. 238. More recent are James K. Good: *The Delimitation of "Southern Indiana"* as an Historical, Contemporary, and Perceptual Region (unpublished M.A. thesis, Dept. of Geography and Geology, Indiana State Univ., Terre Haute, 1974), parts of which appear as: *A Perceptual Delimitation of Southern Indiana*, *Prof. Paper No. 8*, Dept. of Geography and Geology, Indiana State Univ., Terre Haute, 1976, pp. 3-10; Charles L. Lieble: *Regional Consciousness in West Virginia* (unpublished Ph.D. dissertation, Dept. of Geography, Univ. of Tennessee, Knoxville, 1974); and John S. Reed: *The Heart of Dixie: An Essay in Folk Geography*, *Social Forces*, Vol. 54, 1976, pp. 925-939. In addition, some of the material in several recent books relates to perceptual regions. See Roger M. Downs and David Stea: *Maps in Minds: Reflections on Cognitive Mapping* (Harper and Row Publishers, New York, 1977); and Peter Gould and Rodney White: *Mental Maps* (Penguin Books, Inc., Baltimore, 1974).

³ Those who administered the questionnaire were instructed to "tell the persons filling out the questionnaire to select their *home* county. This need not be their county of birth, but it should be the one they identify with most closely."

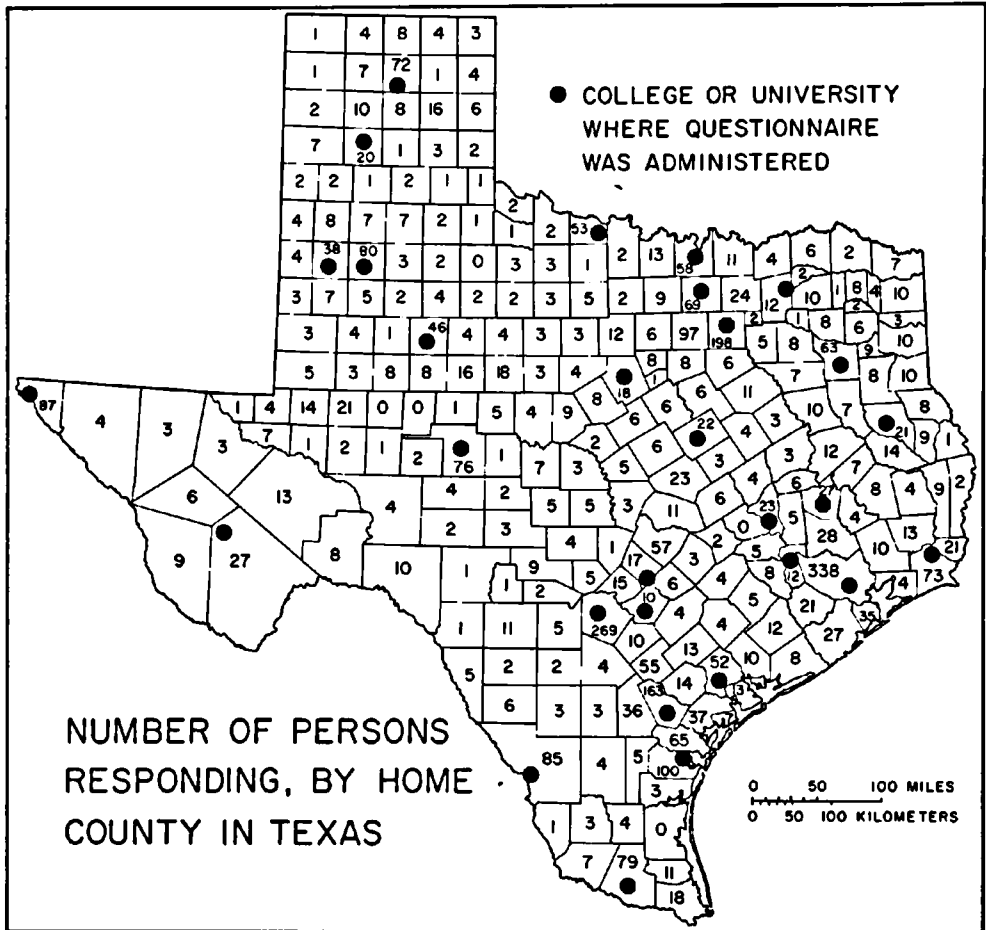


FIG. 1

THE REGIONS

One question was designed to obtain special regional names, or nicknames (Fig. 2 and Table I).⁴ To be included on the map, a vernacular term had to be the most commonly used name in at least one county, to be used by at least 10 percent of the respondents in counties wholly or largely within the region, and to be mentioned by at least five respondents. Wherever practical and appropriate, counties were divided among several vernacular regions, in proportion to the number of responses for each term. Some twenty-nine regions were mentioned consistently enough by respondents to warrant inclusion.

Regions of varying size, type, and degree of recognition were detected. Nineteen, or two-thirds of the regions, bear names based on the physical environment (Table I). As a rule, these environmental terms are old, derived in most cases from the nine-

⁴ The question read: Most parts of Texas have a special regional name, or popular name. . . . Examples of such popular names from other states are "Black Belt" (in Alabama), "North Woods" (in Wisconsin), "Tidewater" (in Virginia), and "Little Dixie" (in Oklahoma). What popular name is used to describe the area containing your home county in Texas? If more than one popular name is used, list all of them. If none are used, please so indicate.

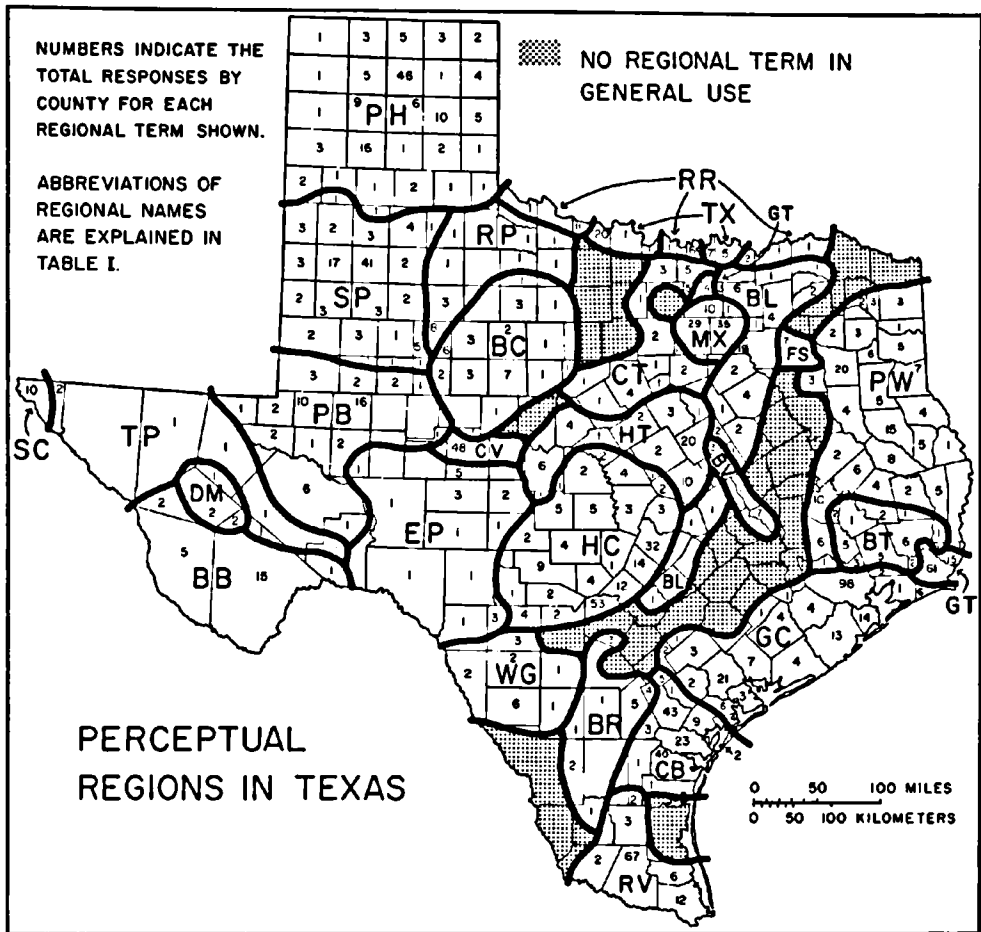


FIG. 2—Selected perceptual regions. Directional terms such as "East Texas" are excluded, as are nicknames of individual cities.

teenth century. "Cross Timbers," for example, was in use at least by the 1840's—even before permanent white colonization of this oak forest area.⁶ Curiously, some of the environmental names do not describe the actual physical character of the land. The "Valley" or "Rio Grande Valley" is not a valley at all but a table-flat coastal plain in South Texas. "Permian Basin" does not describe a topographic basin but refers, instead, to the buried geological structure bearing the petroleum deposits that provide the economic base for this West Texas plains area. Similarly, you have to search long and hard to find the few small, scattered remnants of thicket that are the basis of the "Big Thicket," which in the popular mind covers part or all of eleven counties in southeastern Texas. The vernacular Thicket is presently expanding, at the expense of "Piney Woods," owing to publicity surrounding the creation of Big Thicket national preserve.

Environmental terms, however, seem to be fading in the popular mind—retreating before other types of vernacular regions. Between 1830 and 1850 virtually all of the

⁶ George Wilkins Kendall: *Narrative of the Texan Santa Fé Expedition* (2 vols.; Wiley & Putnam, London, 1844), Vol. 1, pp. 110-111.

TABLE I—PERCEPTUAL REGIONS IN TEXAS

VERNACULAR REGION	PERCENTAGE OF RESPONDENTS USING THIS NAME IN COUNTIES WHOLLY OR LARGELY WITHIN THE REGION	ABBREVIATION USED IN FIGURE 2	TYPE OF NAME
Big Bend	56	BB	Environmental (hydrogeography)
Big Country	38	BC	Promotional
Big Thicket	44	BT	Environmental (flora)
Blacklands	26	BL	Environmental (pedology)
Brazos Valley	27	BV	Environmental (hydrogeography, terrain)
Brush Country	14	BR	Environmental (flora)
Coastal Bend	32	CB	Environmental (hydrogeography, terrain)
Concho Valley	63	CV	Environmental (hydrogeography, terrain)
Cross Timbers	18	CT	Environmental (flora)
Davis Mountains	33	DM	Environmental (terrain)
Edwards Plateau	42	EP	Environmental (terrain)
Free State	88	FS	Political-historical
Golden Triangle (#1) ^a	81	GT	Promotional
Golden Triangle (#2) ^a	20	GT	Promotional
Gulf Coast	32	GC	Environmental (hydrogeography)
Heart of Texas	59	HT	Political
Hill Country	71	HC	Environmental (terrain)
Metroplex	22	MX	Promotional, political
Panhandle	70	PH	Political
Permian Basin	59	PB	Environmental (geology)
Piney Woods	44	PW	Environmental (flora)
Rolling Plains	50	RP	Environmental (terrain)
Red River (Valley)	27	RR	Environmental (hydrogeography, terrain)
(Lower) (Rio Grande) Valley	76	RV	Environmental (hydrogeography)
South Plains	51	SP	Environmental (terrain)
Sun Country	11	SC	Promotional, environmental (climate)
Tex(h)oma (land)	39	TX	Political
Trans-Pecos	20	TP	Environmental (hydrogeography)
Winter Garden	67	WG	Promotional

^a Golden Triangle #1 lies in Southeast Texas; Golden Triangle #2, in North Texas.

Texas regions bore environmental names. Many of these have been nearly or completely forgotten. Vanished altogether are the "Level Region" and the "Undulating Region" that appeared so commonly in guidebooks of the early Anglo settlement period. "Redlands" is an example of an environmental term, once widespread, that has suffered a decline in recent decades. Coined in the 1820's or 1830's, "Redlands" described a belt of thinly forested, fertile, reddish soils in East Texas, centered on the town and county of San Augustine. At San Augustine, a newspaper called the *Red-Lander* began publication as early as 1838.⁶ The Redlands became famous as the best cotton-producing region of East Texas. Apparently the replacement of cotton by pasture and commercial woodland after about 1930 caused "Redlands" to give way slowly to "Piney Woods" as the preferred regional term. Even in San Augustine County, questionnaire respondents listed "Piney Woods" more often than "Redlands" (Fig. 3).

Political terms account for some 14 percent of the Texas vernacular names. One of these, "Panhandle," refers to a peculiarity of the Texas border, while a second,

⁶ Walter P. Webb and H. Bailey Carroll, eds.: *The Handbook of Texas* (2 vols.; Texas State Historical Assn., Austin, 1952), Vol. 2, p. 449.

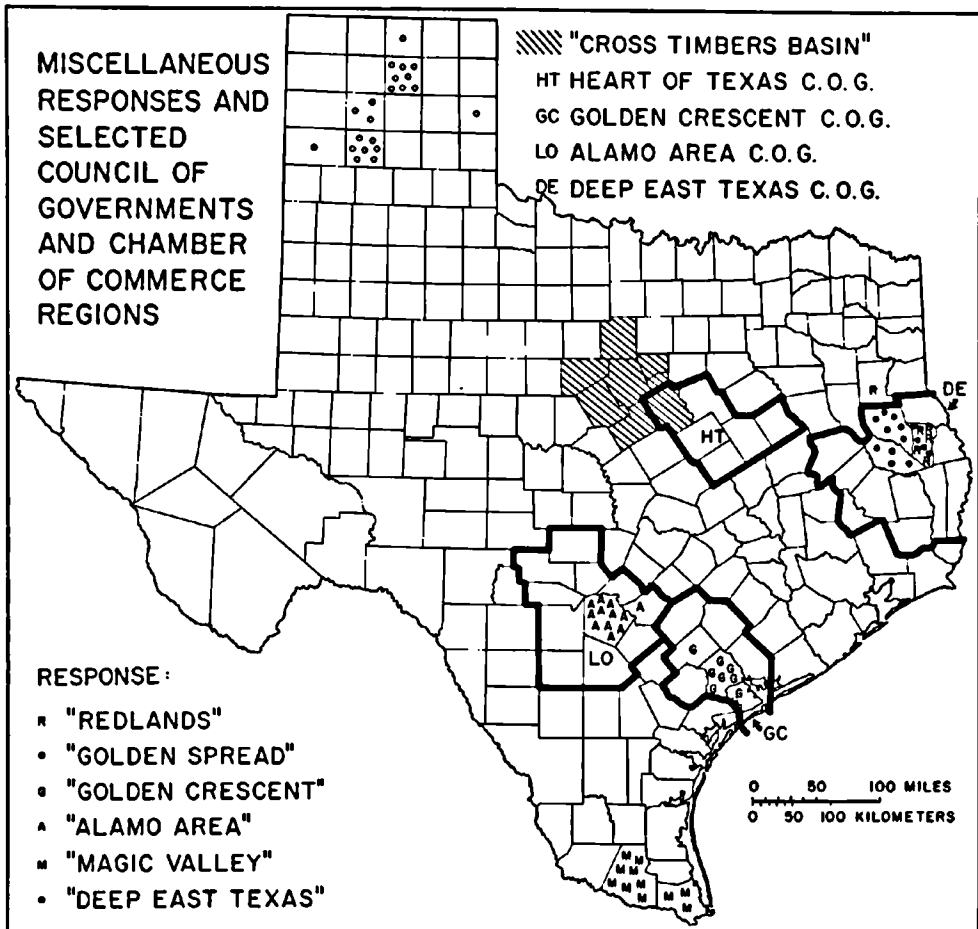


FIG. 3—A selection of miscellaneous responses to the questionnaire, council of governments regions, and chamber of commerce promotional terms. "Golden Spread" endangers the traditional "Panhandle," while "Magic Valley" is a promotional variant of "Rio Grande Valley" or "The Valley." The "Golden Crescent" will probably displace parts of the "Gulf Coast" and "Coastal Bend" in the near future, and "Alamo Area" threatens sections of the "Hill Country" and "Brush Country." The Heart of Texas Council of Governments presently lies largely to the east of the perceptual region of the same name (see Fig. 2), and "Cross Timbers Basin" was recently adopted by a local chamber of commerce.

"Heart of Texas," defines more or less the geographical center of the state (Figs. 2 and 4). "Tex(h)oma" combines the names of Texas and Oklahoma but, curiously, is used only on the Texas side of the Red River. "Free State," like "Panhandle," is a nineteenth-century political term. It refers to Van Zandt County in East Texas, where local tradition holds that a planter, seeking safety during the Civil War from the battle zone of the South, brought his slaves. He found, to his disgust, that almost none of the local Van Zandt farmers, most of whom were "sand flat" poor whites, owned slaves. The planter soon left the county, saying he would as soon take his blacks to a free state as to Van Zandt.⁷ To this day it remains the "Free State of Van Zandt," a title commemorated in the name of a local newspaper. In South Texas, a "Free State of McMullen" was mentioned by one of the three respondents, and a hand-painted

⁷ Jack Geddies: *Of the Colorful Free State* (Grand Saline, Texas, 1942), pp. 26 and 38.

sign at the northern line of McMullen County conveys this vernacular message to highway travelers. Occasionally one also finds reference to a "Free State of Menard."⁸ That these three different counties should bear the vernacular prefix "Free



FIG. 4—The "Heart of Texas" region, enshrined for the ages on the courthouse square of Brady in McCulloch County, near the geographical center of the state. The twenty-nine regional names often appear in the cultural landscape, providing daily visual support for the vernacular regions. Brady's monument, seemingly designed to last forever, is an extreme example of landscape presence.

State" is perhaps some measure of the strength of Texan regionalism, frontier individualism, and distrust of central government.

Promotional names for vernacular regions seem to be the wave of the future. With few exceptions, these appeared on the Texas scene after World War II, some even within the past decade. Typically, promotional names were launched by groups of local boosters, such as chambers of commerce or regional councils of governments, and spread to the general public via news media. These names speak to us of Texan

⁸ See N. H. Pierce: *The Free State of Menard: A History of the County* (Western Advertising Co., Menard, Texas, 1975). In neither Menard nor McMullen was the questionnaire response sufficient to justify placing "Free State" on the map.

pride: "Big Country," "Golden Triangle," "Sun Country" (Fig. 5). The recent, politically motivated decision to combine the Dallas and Fort Worth Standard Metropolitan Statistical Areas gave birth to the promotional name "Metroplex." It is



FIG. 5—Typical Texan boosterism in support of a vernacular region: the "Golden Triangle" of North Texas. The best efforts of local chambers of commerce seem to have failed in this instance, however, for the North Texas Golden Triangle is giving way to "Metroplex." Ten years from now, the Sanger Chamber of Commerce will likely boost their town as the "Gateway to the Metroplex." Billboard proclamations such as this are common in the cultural landscape of Texas and provide visual reinforcement for vernacular regional names.

daily drummed into the consciousness of local residents by newspapers, radio and television announcers, and business owners who incorporate Metroplex into the name of their firms.⁹

A host of other promotional names have arisen recently, but as yet have not displaced older, nonpromotional terms (Figs. 2 and 3). Thus we see the venerable "Panhandle" endangered by "Golden Spread," a name, according to one student respondent, "coined by an Amarillo newsman to encourage tourism and business." Although "Golden Spread" sounds more like an oleomargarine than a geographical region, it is variously said to have been inspired by the expanses of golden wheat fields or to typify "the golden opportunities of the area." As early as 1972, the Amarillo telephone directory contained 9 "Golden Spread" entries, compared with 50 for "Panhandle." Respondents in the region listed "Panhandle" 108 times and "Golden Spread" 21. Similarly, the seam between the ho-hum "Gulf Coast" and "Coastal Bend" seems to be parting and the two regions drifting apart, in a sort of perceptual plate tectonics, to make room for the "Golden Crescent," a name promoted by the council of governments for that area. Elsewhere, a "Golden Circle" has surfaced in the Blacklands south of Dallas, according to one Navarro County respondent.

⁹ Doug Domicier: Metroplex Callers Dial in on President's "Whats Line," *Dallas Morning News*, Mar. 6, 1977, p. 1A. The callers described included one each from Dallas and Fort Worth. The April, 1977, Greater Dallas telephone directory contains seventy-nine "Metroplex" listings.

So enamored are Texans of the adjective "golden" that the state boasts not one but two "Golden Triangles." The older and better established of these, recognized by more than 80 percent of the local population, lies in Southeast Texas, bounded by the cities of Beaumont, Port Arthur, and Orange. Blissfully ignorant of this prototypical "Golden Triangle," boosters of the small city of Denton in North Texas began promoting the Denton-Dallas-Fort Worth triangle as golden (Fig. 5).¹⁰ Denton, naturally, was the "Top of the Golden Triangle." The Denton campaign never entered the consciousness of residents in Dallas or Fort Worth, but small-town folk in nearby communities were converted. "Metrolplex," the preferred name for the Dallas-Fort Worth region, is spreading rapidly and will soon submerge this North Texas "Golden Triangle." Only the apex projects above the drifting metrolplex sands, and soon it will vanish altogether. Even in Denton itself, the telephone directory lists more "Metrolplex" than "Golden Triangle" entries.

Promotional names are generally coined in an urban nucleus and spread outward into surrounding rural and small-town districts. In this sense they approximate nodal regions. "Big Country," for example, has its node at the city of Abilene, is promoted by the Abilene news media, and appears in the names of local business establishments. By contrast, environmental names are typically based in rural areas and often describe the distribution of some physical feature of the region. As such, they are formal regions that have been popularized. The increased urbanization of the state suggests that nodal promotional names will continue to proliferate and expand at the expense of environmental ones. In this sense, it is interesting to watch the spread of "Magic Valley," a promotional variant of "The Valley" or "Rio Grande Valley" (Fig. 3).

The role of councils of governments in fostering regional names varies from one part of Texas to another. The first of these councils was established in the mid-1960's, encouraged by supporting legislation.¹¹ Some have adopted existing vernacular terms, such as "Panhandle," "South Plains," "Brazos Valley," "Coastal Bend," or "Permian Basin," lending further support to established names. Others, however, have created new names, which may eventually attain the status of vernacular regions. The Alamo Area Council of Governments, based in San Antonio, could, for example, displace much of the "Brush Country" and "Hill Country," while also filling part of a region which presently has no popular name. Already, according to the survey, "Alamo Area" is perceived as the local regional name by 4 percent of the Bexar County respondents. The previously mentioned Golden Crescent Council of Governments has a name that can hardly fail in the long run, and the Texoma Regional Planning Commission bears a name that is already in the process of displacing part of the traditional "Red River Valley."

It is noteworthy, however, that territories defined by the councils of governments regions sometimes correspond weakly to the perceptual regions of the same name. For example, the Heart of Texas Council of Governments area lies east of the perceptual region, with an overlap of only three counties.

Reinforcement for dominantly rural perceptual regions often comes from district agencies of the Texas Agricultural Extension Service, whose crop-reporting districts

¹⁰ "A Denton First: Golden Triangle Fat Stock Show," *Denton Record-Chronicle*, Feb. 9, 1977, p. 1D; and Jim Stephenson: Grapevine: The Trauma Has Passed, *Dallas Morning News*, May 29, 1977, p. 1D.

¹¹ For a list of Texas councils of governments, see the *Texas Almanac and State Industrial Guide, 1976-1977*, A. H. Belo Corporation and the *Dallas Morning News*, Dallas, 1975, pp. 557-558.

perpetuate names such as "Panhandle," "Coastal Bend," "South Plains," and "Rolling Plains."¹² Similarly, the use of terms such as "Blacklands" by farm news columnists and correspondents for newspapers and radio stations helps to preserve traditional rural vernacular regions.¹³

A REGION ABORNING

Wilbur Zelinsky once recounted his personal remembrance of "surfing" along an innovation wave of hula hoops across the United States.¹⁴ I cannot equal that experience, but I was present at the birth of a perceptual region. "Chamber of Commerce Hold Contest to Name Our Area," proclaimed a headline in the *Stephenville Empire-Tribune* in the spring of 1977.¹⁵ "Names submitted for the contest should reflect the character, heritage, geography, or similar identifying feature of the area centered in Erath, Comanche, Eastland, Palo Pinto, Hood, Hamilton and Bosque counties." The chamber noted that "many other areas of the state already have an identifying name—such as Dallas-Fort Worth's Metroplex, Abilene's Big Country, and Waco's Heart of Texas."

Perhaps the Stephenville Chamber of Commerce was aware that the traditional environmental term "Cross Timbers" was still weakly perceived as the vernacular name of this largely rural region, for the winning selection was "Cross Timbers Basin, . . . a familiar term with a slightly new twist."¹⁶ Rural tradition had overcome flashy boosterism, causing the rejection of entries such as "Centroplex," "Eye of Texas," "Inland Empire," "Agri-Plex," and "Clearwater Country." The newspaper promised that "Cross Timbers Basin will be used by the Chamber of Commerce and the *Empire-Tribune* in the future in referring to this area, and other groups, businesses, and organizations have been urged to do the same." Because the area in question is not a topographic basin, it is possible that the suffix will eventually be dropped, leaving the venerable "Cross Timbers" unaltered. I seem to have witnessed not so much the birth of a new vernacular region as the phoenix-like revival of a dying one.

PERCEPTION OF REGIONAL BORDERS

Answers to questions indicated that to many respondents the boundaries of perceptual regions are often distinct. Thus Bexar County lies on the "border of the Hill Country and Brush Country" and Jim Wells County "on the edge of the Rio Grande Valley; people often refer to it as being in the 'Valley' anyway." Another student described Bexar County as "near the 'Hill Country' but not really in it," while still another remarked that "north of San Antonio is referred to as 'the Hill Country.'" A Palo Pinto resident placed this county "west of the Metroplex," and Mitchell County was described as part of the "Permian Basin, although we are east of that." Scurry County is situated at the "bottom of the South Plains, at the northwest

¹² "South Texas Vegetable, Citrus Growers Could Be Sitting on Crop Goldmine," *Dallas Morning News*, Jan. 30, 1977, p. 54D.

¹³ Murray Cox: On the Farm: Blacklands State Comeback, *Dallas Morning News*, Jan. 30, 1977, p. 54D.

¹⁴ Wilbur Zelinsky: *The Cultural Geography of the United States* (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1973), p. 80.

¹⁵ "Chamber of Commerce Holds Contest to Name Our Area," *Stephenville Empire-Tribune*, Apr. 10, 1977, p. 1. I am grateful to Professor William Eugene Atkinson of Tarleton State University, Stephenville, for calling my attention to this contest and for sending me copies of the local newspaper.

¹⁶ "Cross Timbers Basin Wins Name Contest," *Stephenville Empire-Tribune*, May 12, 1977, p. 1.

end of the Rolling Plains." Numerous respondents listed more than one vernacular name for their area.

A curiosity of the map is the belt that crosses the middle of Texas where no popular names are in common use. This indistinctly bounded zone stretches from the northeastern corner of the state southwest beyond San Antonio. Some rural respondents attempted to fill this vacuum with a traditional, though almost vanished, environmental term, the "Post Oak Belt." A majority however, reported no name. In the near future, this long, narrow strip is likely to be filled by "Alamo Area," "Brazos Valley," "Ark-Tex," and other councils of governments names, as well as "Metropolitan" and perhaps "Golden Circle." Civic pride abhors a regional vernacular vacuum. I find it noteworthy, however, that this belt describes almost exactly the old border zone between cultural impulses received from the Lower South and Middle Atlantic in the nineteenth century.¹⁷ To the east of this zone the traditional culture, society, and economy are those of the Deep South; to the west, the influence of Missouri, Arkansas, Tennessee, and Appalachia prevails. Also, much of the border zone falls within Donald Meinig's "Central Texas," an area of thorough mixing of the various Texan cultures, suggesting that a diversity of peoples has hindered the rise of a widely accepted nickname.¹⁸

POSITIVE VERSUS NEGATIVE PERCEPTIONS

The frequency of "Big" and "Golden" as prefixes suggests that the Texan self-image is overwhelmingly positive. Five of the twenty-nine major regions bear these descriptive adjectives in their names (Table I). Three different counties were described by individual respondents as "God's Country," several as part of the "Sun Belt," and one as the "Navel of the Universe." Terms such as "Valley of the Palms" and "Sparkling Cities by the Sea" appeared frequently.

Other responses, however, suggest a perception quite the opposite. Often couched in facetious terms, these negative views are of considerable interest to students of popular culture. Some were references to the physical environment—"Dust Bowl," "Tornado Alley," "Bog Hole," "The Sand Dune," "Barren Wasteland," or similar terms (Fig. 6). Derogatory environmental names were concentrated mostly in central West Texas and along the southern fringe of the state.

Negative cultural names, or epithets, were also fairly common. Many, such as "in the sticks," "end of the world," and "eight miles south of the end of the world" (a distinction awarded to Crockett County by one of her native sons), spoke of remoteness and isolation. Others were less specific but equally negative. Nueces County can claim only to be the "armpit of Texas" and El Paso County the "armpit of the Southwest," but according to disgruntled residents Jefferson County is the "armpit of the world" and Midland County the "armpit of the universe."

Ethnicity was also evident in many of the perceptions, most commonly as slurs but occasionally reflective of a positive self-image among minority groups. Slurs ranged from such anti-Hispanic terms as "Grease Belt," "Brown Bend," "Wetback's Towel," and "Tortilla Flat," to "Redneck Holler," the "Valley of the Krauts," and "KKK Kountry" (Fig. 7). The distribution of anti-Hispanic slurs neatly outlines the

¹⁷ Terry G. Jordan: *The Imprint of the Upper and Lower South on Mid-Nineteenth-Century Texas*, *Annals Assn. of Amer. Geogr.*, Vol. 57, 1967, pp. 667-690.

¹⁸ Donald W. Meinig: *Imperial Texas: An Interpretive Essay in Cultural Geography* (Univ. of Texas Press, Austin and London, 1969), pp. 93 and 108-109.

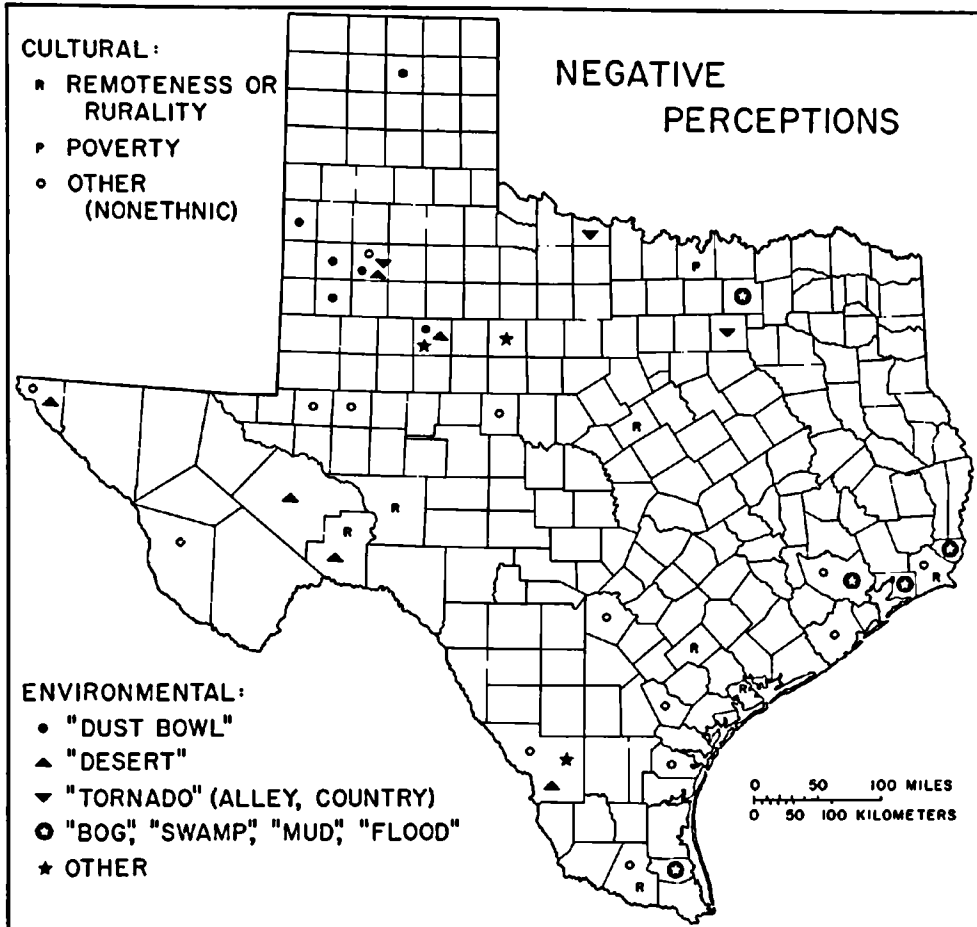


FIG. 6—Negative perceptions revealed by the questionnaire. Some of these responses were obviously meant facetiously, but others, such as "Dust Bowl" and "Tornado Alley," were probably sincere.

South Texas zone of political and economic tension between Anglo and Mexicano. Similarly, the frequent use of "El Valle (del Río Grande)" instead of "Rio Grande Valley," the description of El Paso County as "Baja Nuevo Mexico," and the occasional reference to "Sur Texas" (probably to stress the desires of Hispano separatists to create a fifty-first state out of southern Texas) reveal rising Mexican-American cultural and political awareness. The presence of other ethnic groups is revealed by such terms as "Cajun Country," "Czechville," and "Wurst Area."

THE BIBLE BELT

Although the questionnaire was not designed or intended to elicit multistate vernacular regions such as "Sun Belt," "Cotton Belt," or "Bible Belt," a substantial number of respondents listed such terms. Apparently a great many Texans know and use "Bible Belt" to describe their home area, and my own familiarity with these people leads me to conclude that, for most of them, the term represents a positive statement about their county of residence. The survey suggests that roughly the northern half of Texas is perceived by its inhabitants to lie in the Bible Belt (Fig. 7).

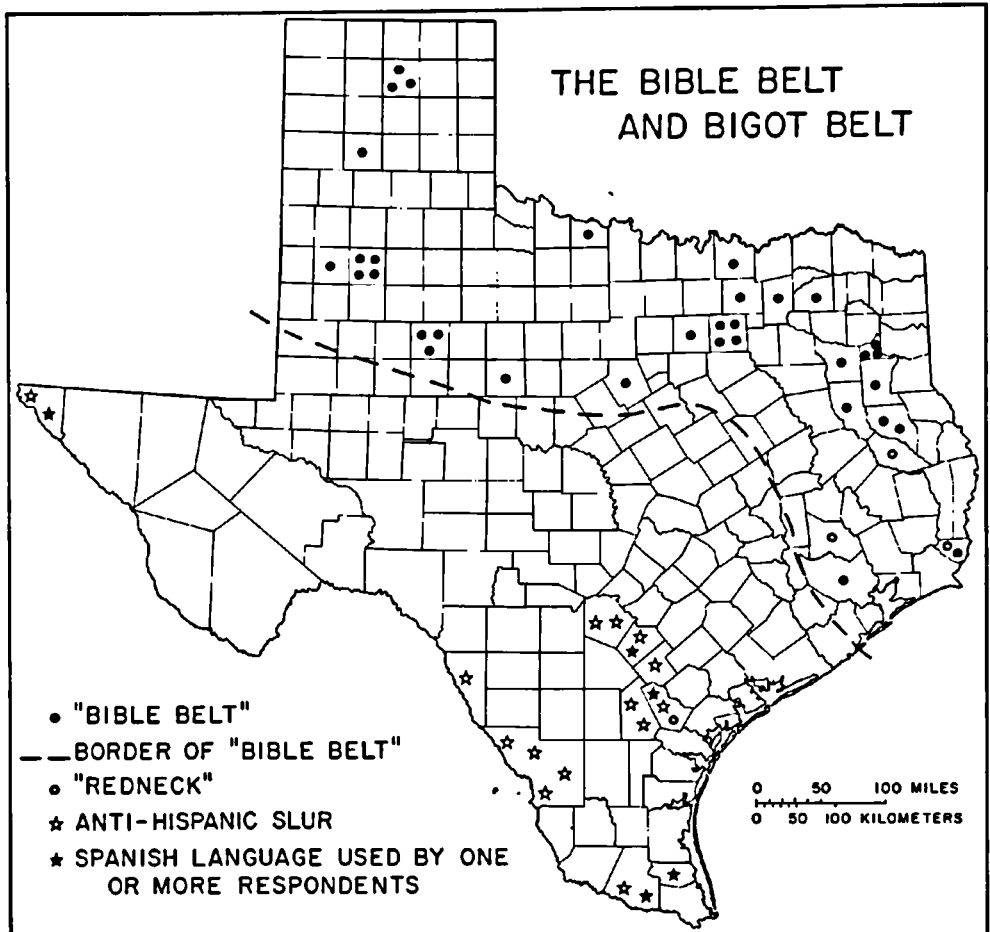


FIG. 7—The Bible and bigot belts. It should be stressed that no questions were designed to elicit multistate terms such as "Bible Belt." Perception of the "Bible Belt" is no doubt much stronger than is suggested here.

In counties where sizable numbers of Mexican-American or European ethnics live, the term Bible Belt is not in use. Rather, it is restricted to the areas dominated by old-stock Anglo- and Afro-Americans.

Although the Bible Belt has been much publicized, even in works by cultural geographers, no one, so far as I know, has ever attempted to map it as a vernacular region. Perhaps for this reason, no two writers who use the term agree on exactly where the Bible Belt is. Some regard it as a distinctly southern phenomenon, while others include localities as far afield as Indianapolis and Kansas. I would argue that the perceptual approach may be the best method for geographers to employ in treating such regions. My Texas findings strongly suggest that such a method could produce meaningful results.

DIRECTIONAL TERMS

In addition to popular names or nicknames, most Texans surveyed also use compass-direction terms and "central" to describe various parts of the state (Fig. 8).

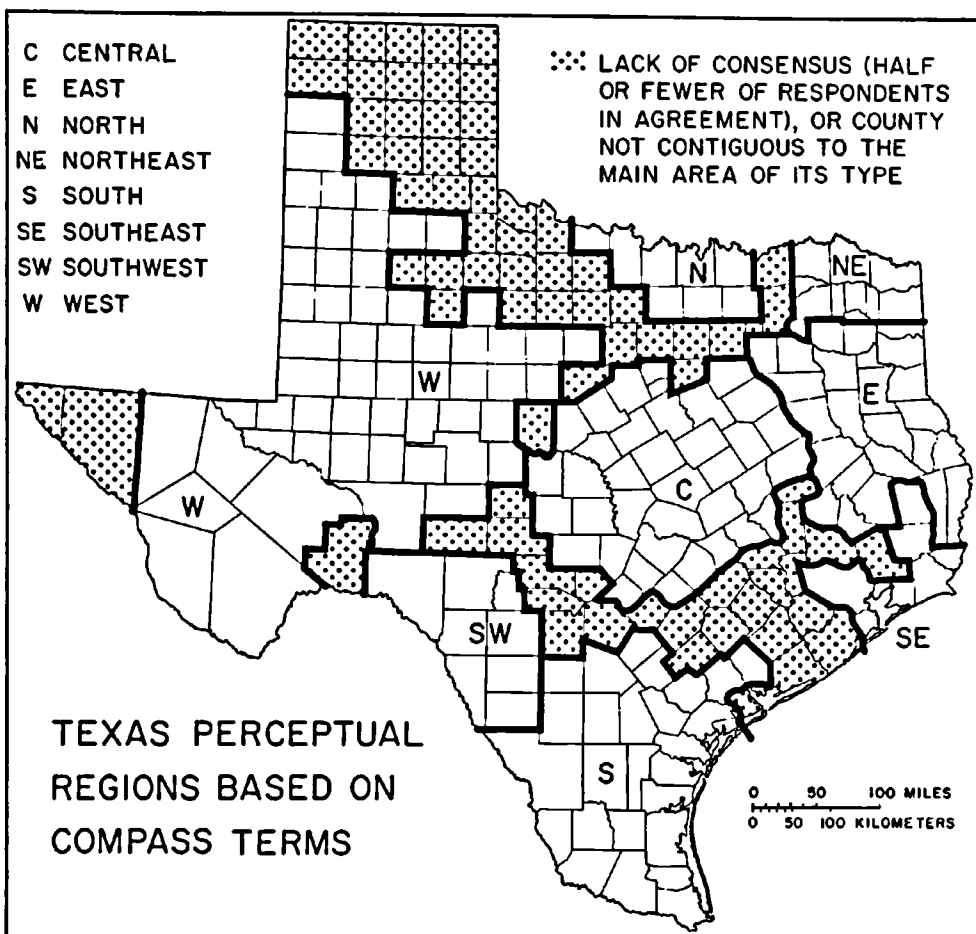


FIG. 8—Directional terms as perceptual regions. In some "lack of consensus" counties, especially in the far western tip of Texas and in the Panhandle, many respondents indicated that no compass or other directional terms were in use.

A second query was designed to reveal the distribution and use of such terms.¹⁹ Texans have long argued about where West Texas begins, and how extensive East Texas is, but no previous attempt to survey the people has been made. To be included in one of my directional-term vernacular regions, a county had to have a uniform response from at least 51 percent of the respondents and to be contiguous with the territorial bulk of counties in the region.

¹⁹ The question read: Residents of most parts of Texas identify their home counties by using one of the compass directions. Which, if any, of the following terms is used locally to identify the location of your county? If appropriate, more than one blank can be checked. Check only the term(s) you have heard used by the inhabitants of the county.

_____ East Texas
_____ North Texas
_____ South Texas
_____ West Texas
_____ Central Texas

_____ Northeast Texas
_____ Southeast Texas
_____ Northwest Texas
_____ Southwest Texas
_____ none of these are used by local
people to describe my county

(Other (specify) _____)

It has long been a favorite practice of those writing about the Texas scene to place Dallas in East Texas, thus reflecting its traditional ties to cotton and oil production in the eastern part of the state, and to place nearby Fort Worth in West Texas, showing its link to the ranching country. The survey failed to provide support for this venerable notion. Vernacular "West Texas" proved to be the largest compass region, consisting of a wedge-shaped territory that broadened to the west, but Fort Worth, which long claimed to be "where the West begins," is in fact three counties removed from the easternmost reaches of West Texas. More of the respondents from Tarrant County, the site of Fort Worth, identify with "East," "Northeast," and "North" than with "West." Abilene in Taylor County, long touted as "out where the West is at," lies instead in the easternmost tip of vernacular West Texas.

"Southeast," "Northeast," "Southwest," and "North" Texas are perceived as rather confined border regions. Only one of these, "Southeast Texas," enjoys council of governments support, in the form of the "South East Texas Regional Planning Commission." However, a Nortex Regional Planning Commission is centered at Wichita Falls.

"East Texas," of all the compass regions, displays the highest overall degree of identification and the sharpest borders. The Trinity River marks most of its western boundary. Loaded with connotations of the Old South and the defeated Confederacy, "East Texas" is seemingly the most potent in degree of recognition and emotional impact of all popular regions of any description in the state. An interesting variant detected was "Deep East Texas" (Fig. 3). To some this traditional term means the area immediately adjacent to Louisiana, but the majority perceive it as the southern half of "East Texas."²⁰ The Deep East Texas Council of Governments adheres to the more inclusive definition, as did many of the questionnaire respondents.

Adding the responses for "East," "Southeast," and "Northeast" and those for "West," "Southwest," and "Northwest" resulted in a second spatial definition of East and West Texas. The border of greater West Texas seldom ranges far from the 100° meridian, while that of expanded East Texas runs roughly from Dallas to Houston.

"Central Texas," increasingly referred to as "The Centex," occupies a sizable block of counties positioned east of center in the state. Perceptual "Central Texas" corresponds very closely to Meinig's region of this name.²¹ "South Texas" is a sizable region with rather blurred borders, defining spatially the major Hispanic stronghold in the state. It carries definite ethnic connotations in the minds of most Texans.

Narrow transition zones, composed of counties in which half or less of the respondents could agree on a compass term, serve as buffer areas between most of the regions. An exception is the Panhandle, where a sizable undecided block of counties is found. This area corresponds closely to the part of Texas that belongs to the perceptual "Midwest," according to Brownell.²² Curiously, some of the largest cities in Texas, including Dallas, Fort Worth, El Paso, and San Antonio, lie in transition areas.

Unlikely as it may seem, the majority of home county students at East Texas State

²⁰ See Terry G. Jordan: *Deep East Texas Folk* (Southern Methodist Univ. Printing Dept., Dallas, 1976), pp. 3-5.

²¹ Meinig, *op. cit.* [see footnote 18 above], p. 93.

²² Brownell, *op. cit.* [see footnote 1 above], p. 83. See also Meinig, *op. cit.* [see footnote 18 above], pp. 106-107.

University, in Hunt County, did not place their county in East Texas, nor were those at West Texas State or Southwest Texas State universities swayed by the names of their institutions. Only North Texas State students answered in a predictable manner, and even there the majority was small.

As before, many respondents perceived rather exact boundaries of these regions. Tom Green County was placed on "the eastern fringe of West Texas," for example, and Clay County lay on the "boundary or edge of West Texas."

ONE KEY TO REGIONALISM

As geographers, we ought to know more about perceptual regions than we do, at various scales and in different parts of the world. Spatial patterns, behavior, organization, and flows are among our traditional concerns, and we should be able to understand these better if we know how populations perceive regions. A perceptual Bible Belt has great potential value for the cultural geographer; a perceptual Sun Belt could be helpful to economic geographers and planners; a map of perceived neighborhoods within individual cities might assist urban geographers in interpreting the city mosaic; and perceptual regions at almost any scale should further our understanding of "places." From behavioral psychology we have borrowed methodology sufficient to carry out scientific studies of perceptual regions. It seems an obvious and natural task for geographers, one which would supplement our long-standing attention to functional and formal regions.²³

²³ G. W. S. Robinson: The Geographical Region: Form and Function, *Scottish Geogr. Mag.*, Vol. 69, 1953, pp. 49-58.

THE EMERGENCE OF A NEW "DOWNTOWN"*

THOMAS J. BAERWALD

THE freeways encircling large metropolises in the United States have spawned new business complexes that threaten the traditional supremacy of the central business district (CBD). Suburbanites and a large share of the central-city population have reoriented their lives to one or more of these new "downtowns," while the CBD has decayed. The suburban freeway corridor (SFC) now houses a complete mix of the business establishments regularly frequented by the geographically mobile middle- and upper-class residents of the modern metropolis. Light industrial plants, warehouses, and office buildings along the freeway employ breadwinners; homemakers shop at large supermarkets and regional shopping malls; and motor hotels, bars, restaurants, nightclubs, and sports complexes attract those in search of entertainment.¹

The rise of the suburban freeway corridor as a dominant metropolitan focus has been a national phenomenon. Many Atlantans find the "Perimeter" Highway more important than Peachtree Street, and many Houstonians order their lives along the "Loop." The Tri-State and Northwest tollways near O'Hare airport exhibit the greatest development of the SFC in the Chicago area, and many corridors along Southern California freeways obviate travel to destinations in the Los Angeles CBD.

The suburban freeway corridor may be the functional successor of the central business district, but the two differ significantly. The CBD is a nucleation. It is linked to the rest of the metropolis by radial routes traversed by many modes, but it is arranged internally for pedestrian movement. In contrast, the SFC is linear and depends entirely on cars and trucks for internal and external movement. It is almost impossible to walk from one establishment to another, and public transit, if any serves the corridor, is infrequent and inconvenient. As a result, use of the CBD is increasingly dominated by people who cannot afford to operate the automobiles required in the SFC, whereas the corridor garners an ever-increasing share of the metropolitan area's business.

A more significant difference between the suburban freeway corridor and the central business district results from their development histories. The CBD has undergone a long and complex sequence of expansion, redevelopment, and change. The SFC, on the other hand, developed at a radically different scale in time and space. The corridor is still essentially in its original developed form, because it has been more economical and convenient to build on vacant land than to convert developed property to different uses. The general development of the corridor is therefore best explained in terms of the relative timing of development and the availability of vacant land. When did each land use develop? Which of the locations available when it developed best suited its purposes? Answers to these questions

* My thanks go to the many people who helped me in the preparation of this article, especially John Fraser Hart, John R. Borchert, Philip M. Raup, and Eric S. Sheppard.

¹ The most recent comprehensive summary of research on the dispersion of nonresidential functions in American metropolitan areas is in Peter O. Muller: *The Outer City: Geographical Consequences of the Urbanization of the Suburbs*, (*Assn. of Amer. Geogrs., Resource Paper 75-2*, Washington, D.C., 1976), pp. 29-46.

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provide an initial geographical understanding of these new metropolitan "downtowns."

A MODEL OF DEVELOPMENT

A seven-mile stretch along Interstate Highway 494 (I-494) south of Minneapolis is the largest and most highly developed SFC in the Minneapolis-St. Paul metropolitan area (Figs. 1 and 2). It is representative of the new complexes I have noticed in other metropolises, and because of its proximity and the availability of information about it, I selected it for study as an example of suburban freeway corridor development. The half-mile-wide I-494 corridor has become the third "downtown" in the Twin Cities area over the past quarter century.² It extends from the Twin Cities International Airport westward to State Highway 100.³

Land use maps at four- and five-year intervals between 1953 and 1976 illustrate the development of the I-494 corridor (Fig. 3). Standard principal component analysis of data from these maps showed virtually no locational correlation between the various land uses. No uses attracted or repelled others, emphasizing that corridor uses were essentially interchangeable and that their pattern was a function of the timing of development and the availability of land. Four stages of corridor development were identified by another standard principal component analysis, and three-mode principal component analysis distinguished the predominant development of certain land uses in specific corridor locations during each stage.⁴

STAGE 1: INITIAL DEVELOPMENT

The first stage consisted primarily of early postwar residential development through the middle 1950's. The outward wave of single-family homes from the central

² The I-494 corridor is now probably the second most important concentration of private sector employment in the Twin Cities area. According to statistics provided by the Metropolitan Council of the Twin Cities area, more than 38,000 persons worked for private firms in traffic analysis zones along the freeway in 1970, and the total was increasing rapidly, overtaking the St. Paul CBD, which employed 45,000. Furthermore, a proliferation of restaurants, nightclubs, bars, and hotel rooms elevated the I-494 "strip" past both CBDs as the metropolitan area's "nighttime capital" and foremost business meeting center.

³ The I-494 corridor includes land in three municipalities, Bloomington, Richfield, and Edina. For the statistical analysis of land use change, the study area was defined as bounded on the east by 34th Avenue; on the north by a line one-quarter mile north of the Bloomington city limits; on the west by a line one-quarter mile west of State Highway 100; and on the south by a line one-half mile south of the city limits west of Xerxes Avenue and by a line one-quarter mile south of the city limits east of Xerxes.

⁴ Three-mode principal component analysis is a form of multimode factor analysis, a data simplification procedure developed by Ledyard R. Tucker, described in his *Implications of Factor Analysis of Three-Way Matrices for Measurement of Change*, in *Problems in Measuring Change* (edited by Chester W. Harris; Univ. of Wisconsin Press, Madison, 1963), pp. 122-137; and in his *Experiments in Multi-Mode Factor Analysis*, in *Proceedings of the 1964 Invitational Conference on Testing Problems* (Educational Testing Service, Princeton, N.J., 1965), pp. 46-57. The only published geographical study that has used the procedure is R. G. Cant: *Changes in the Location of Manufacturing in New Zealand, 1957-1968: An Application of Three-Mode Factor Analysis*, *New Zealand Geographer*, Vol. 27, 1971, pp. 38-53. The procedure may be used with any data matrix with observations recorded for each of three types or modes of variables. Each cell of the I-494 data matrix consisted of measurements of land use change for (A) eight land use classes during (B) six periods in (C) ten districts. Standard principal component analysis using varimax rotation of a rearranged data matrix arraying A against B and C produced eight land use components. Comparable analysis of the matrix with B against A and C yielded four time components, and analysis of the matrix with C against A and B produced six locational components. The three-mode data matrix was then multiplied by the three component loading matrices to produce a core matrix. Elements of this core matrix provided relative measures of the degree to which components from each of the standard analyses were associated with one another. Further details of the use of this procedure on the I-494 land use data will be provided by the author on request.

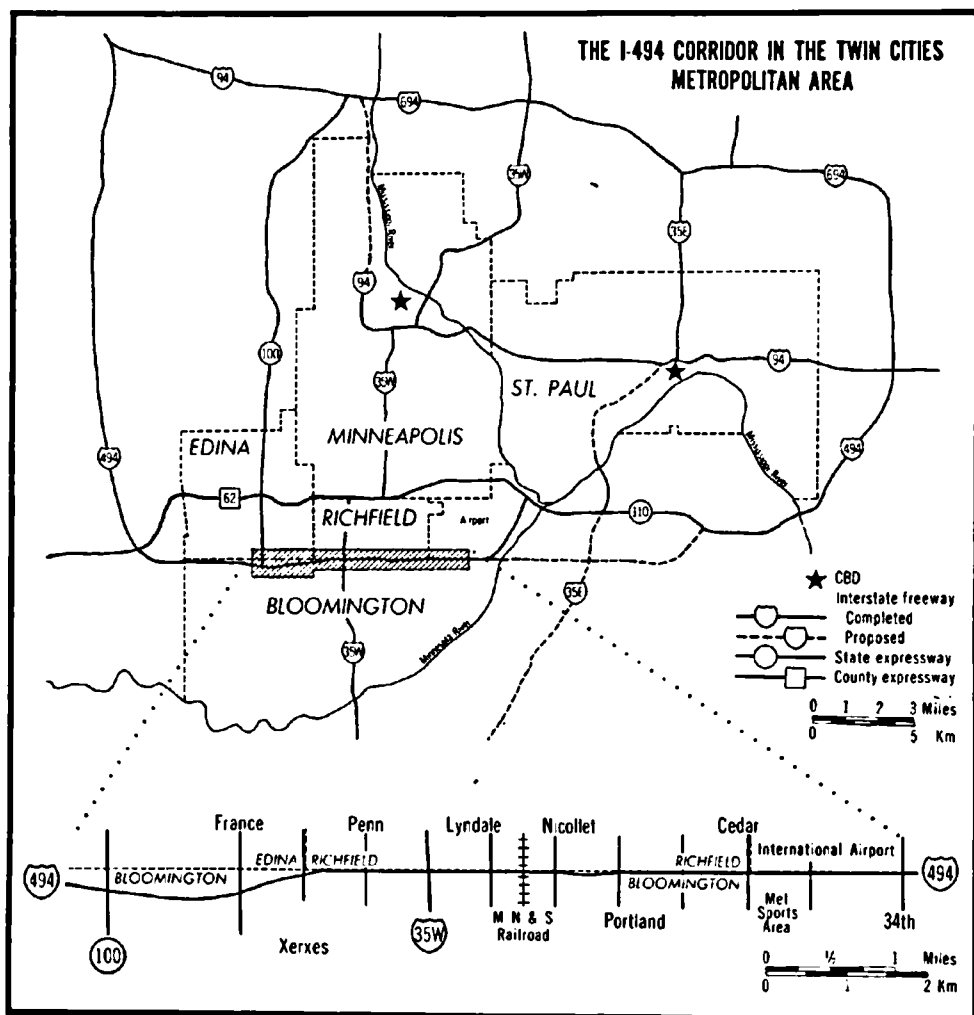


FIG. 1

city encroached on a highway occupying the planned route of a freeway bypass.⁵ Uncertainty regarding the freeway alignment and the promise of higher land values with increased traffic persuaded most landowners to hold property adjacent to the highway for later development. As a result, residential construction terminated abruptly one block from the highway and did not proceed with as much intensity on the other side (Fig. 4).

Residential development was also responsible for the first influx of industrial and wholesale uses into the corridor. Building materials processing plants and sale yards and heavy equipment dealers served the active construction industry where a branch rail line crossed the highway.

⁵ The Minnesota Highway Department formed plans for a State Highway 100 Beltline around the entire Twin Cities area in the early 1950's. Right-of-way acquisitions in the southern suburbs were such that when massive federal funding became available, construction of I-494 through the corridor began in 1958. The freeway opened in 1960 as the Twin Cities' first completed Interstate segment.



FIG. 2—The I-494 corridor stands out as a broad swath of concrete and asphalt through the tree canopy of early postwar suburban housing. In this view looking west, the Minneapolis-St. Paul International Airport is in the right foreground and Metropolitan Stadium and Sports Center are to the left. (Photograph courtesy of Bordner Consultants, Bloomington, Minn.)

STAGE 2: INDUSTRIAL DIVERSIFICATION AND COMMERCIAL EXPANSION

The second stage of corridor development lasted from the late 1950's to the late 1960's. Construction of the freeway by the early 1960's "fixed" property lines, so landowners were able to construct facilities without fear of later condemnation. The freeway also dramatically increased the speed and volume of automobile and truck traffic along the corridor, leading light processors and general distributors to develop

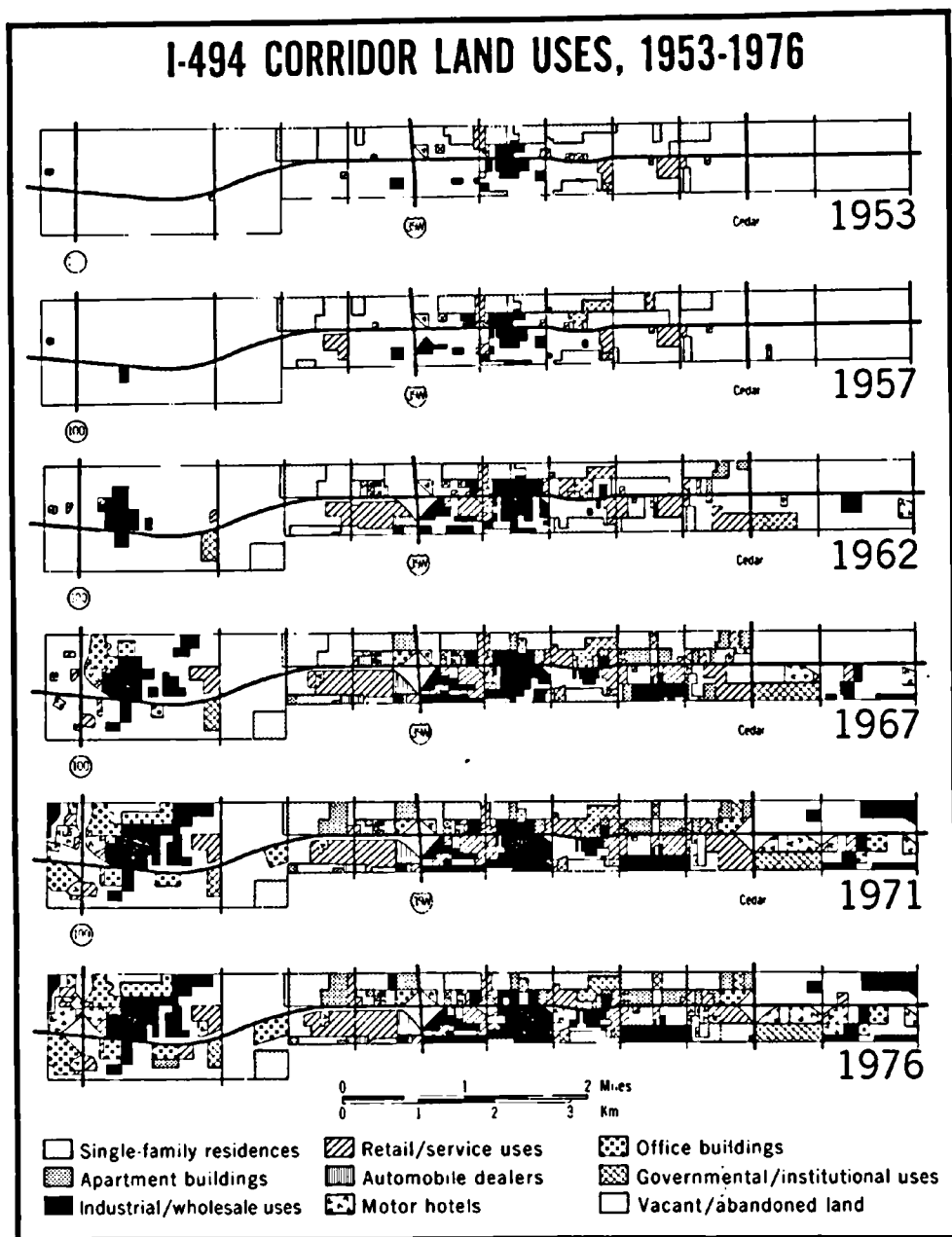


FIG. 3

central sites. Relatively inexpensive land was available for the construction of efficient one-story plants and warehouses, and the corridor also offered easy access for freight shipments, plentiful parking for commuters, and the progressive image of a suburban address.

In the latter part of the second stage, electronics, computer-oriented, and other "Space Age" industries responded to the same inducements, but the airport, inter-

changes with other major highways, and the greater availability of land attracted these activities toward the ends of the corridor (Fig. 5). This trend has continued to the present, with industrial and wholesale uses occupying vacant parcels scattered throughout the corridor, especially toward the ends.

Commercial uses flooded the corridor during the second stage. Stores in small neighborhood shopping centers and commercial strips were overwhelmed by automobile dealers, discount department stores, and large shopping centers. Previous retail



FIG. 4—The corridor between Lyndale and 12th avenues in 1953. The southward wave of residential expansion skipped over land on either side of State Highway 5, the route later followed by I-494. Nonresidential uses in the corridor included (from left to right) construction-related plants and yards along the Minneapolis, Northfield & Southern Railroad tracks, a church and school complex north of the highway, a small neighborhood shopping center at Portland Avenue, and a drive-in movie theater. (Photograph courtesy of U.S. Department of Agriculture.)

nucleations were oriented toward the arterials crossing the corridor, but the newer concentrations clustered around major interchanges and were strung out along frontage roads. The more important the interchange, the larger and more numerous were nearby commercial establishments. The interchange of a radial and the circumferential freeway was the corridor's most prestigious commercial location, and the highest-order shopping center and other retailers dependent on high visibility, such as auto dealers, aggressively occupied property within a half-mile radius (Fig. 6). By the late 1960's, the corridor's commercial pattern was essentially set, with only minor changes in later stages.

STAGE 3: SPECULATIVE DEVELOPMENT

Corridor development in the third stage, from the late 1960's to the early 1970's, was strongly influenced by favorable economic conditions. More money was available

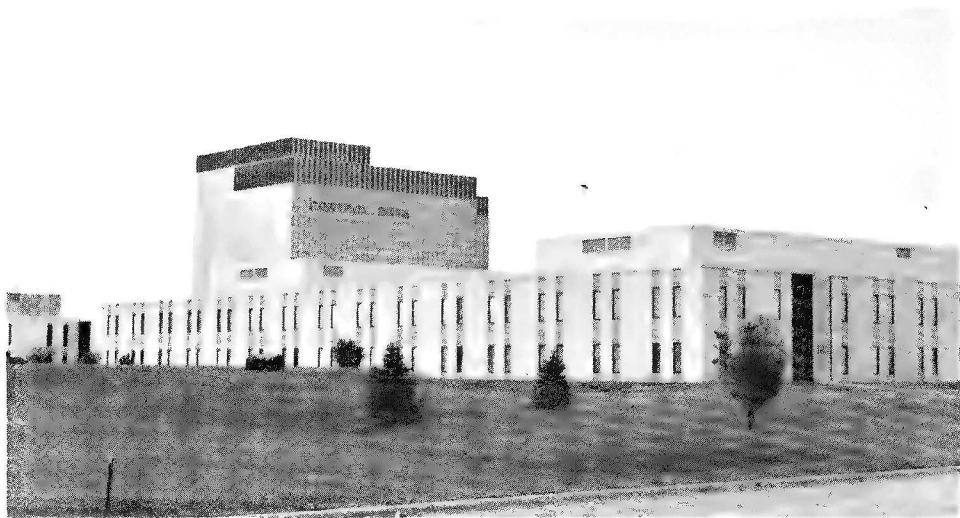


FIG. 5—Control Data Corporation built its headquarters office building and some associated plants in several phases on a large parcel near the airport at the eastern end of the corridor. Control Data also built a large plant at the western end.



FIG. 6—The importance of the I-494/I-35W interchange is illustrated by the Naegele Outdoor Advertising Company's headquarters office building, a giant billboard proclaiming the firm's success. This is the only office building in the central part of the corridor. The I-494/I-35W interchange otherwise is dominated by automobile dealers and high-order merchants.

for investment, and real estate development was encouraged by the rapid appreciation of corridor land values.⁶ Capital gains tax rates at approximately half the regular rate and accelerated depreciation schedules that allowed for substantial losses to offset other income further induced investors to purchase and develop land and then sell it for a sizable profit. In a "can't fail" atmosphere, numerous "rapid return" apartment houses, office buildings, and motor hotels were constructed in the corridor.

Apartment buildings occupied vacant parcels in the center of the corridor where earlier single-family home development had not left enough land for large-scale industrial and commercial uses. Apartment construction on these parcels began in the second stage and intensified in the third. Office uses required larger and more accessible sites, so individual office buildings and office-park complexes gravitated toward the ends of the corridor. Easy access, high visibility, and plentiful land also attracted motor hotels toward the major peripheral interchanges.

STAGE 4: INITIAL REDEVELOPMENT

Little vacant land awaited development by the mid-1970's, and the economic recession severely dampened the speculative fervor of the third stage. Less desirable commercial locations experienced a "filtering down" of functions. Older neighborhood shopping centers increasingly were occupied by "bargain," "discount," or "second-hand" retailers (Fig. 7). Competition for retail space at more accessible sites also resulted in high turnover, but in an upward direction, as high-ordered uses replaced more locally oriented establishments. A few retailers abandoned their property altogether when no subsequent tenants were found. Some of the corridor's original construction-related activities also outlived their usefulness, but the high accessibility of these parcels attracted a new set of industrial users, providing the first evidence of corridor redevelopment.

GENERAL CHARACTERISTICS OF SFC DEVELOPMENT

Circumferential freeways generally experienced the most intensive SFC development because they contain a wide variety of sites of approximately equal accessibility from other places in the metropolis and its hinterland. Radial freeways, by contrast, are oriented toward a smaller sector of the hinterland and offer sites of substantially different distances from the CBD and other important metropolitan nodes. If a metropolis had no circumferential freeway, its SFCs grew outward because of coalescing developments around successively more distant interchanges. The presence of a circumferential freeway had a much different effect on the form and timing of SFC development, however. The circumferential freeway acted as a permeable barrier to the wave of early postwar single-family houses, leading to more scattered residential development on the far sites. Apartment buildings were added later on parcels that were not attractive to commercial and industrial uses.

Commercial development was concentrated around the central circumferential freeway interchanges. Retailers, services, restaurants, and other consumer-oriented establishments outbid other uses for these accessible and highly visible locations in

⁶ Some examples of raw land appreciation recorded by the Bloomington city assessor included a 7.5-acre parcel near the eastern end of the corridor that was assessed at \$18,230 in 1962 and at \$557,700 in 1975 (a thirty-fold increase in value), and an 0.8-acre site near the western end that was assessed at \$750 in 1960 and \$102,400 in 1975 (an appreciation of 136 times the earlier value).

the earlier stages. In SFCs containing a major shopping mall, localized development has continued to the present, but corridors that evolved without the dominant regional shopping node, such as the I-494 corridor, saw much less new commercial activity in the later stages.⁷ In either set of SFCs, there was little commercial development toward the ends of the corridors.

Office buildings were constructed in later stages of corridor development in response to increasing demands for suburban office space and to speculative economic



FIG. 7—"Bargain" stores now dominate the corridor's oldest shopping center, replacing locally oriented merchants who can no longer compete for corridor sites.

conditions. Large office buildings and office-park complexes were built in peripheral parts of the corridors where large tracts of land were still available.⁸ Late arrival to the SFCs also resulted in peripheral locations for motor hotels, although factors such as the presence of an airport or sports complex undoubtedly influenced the particular development of specific corridors.

Industrial development initially was influenced by railroad proximity, but the expansion of plants, warehouses, and complementary activities resulted from the excellent access the freeways provided for almost all corridor locations.⁹ Industrial and wholesale activities adapted most readily to sites not already taken for residences

⁷ The major regional shopping mall for Minneapolis's southern suburbs, Southdale, was oriented to County Highway 62, a smaller expressway that parallels I-494 two miles to the north. Southdale was opened in 1956, four years before I-494 was completed, as the first enclosed mall shopping center in the United States.

⁸ The I-494 corridor contained 3.2 million net square feet of office space in 1973, almost half as much as the St. Paul CBD. More than two-thirds of that space was in office parks ("Office Space: An Inventory and Forecast for the Twin Cities Metropolitan Area" [Metropolitan Council, St. Paul, Minn., 1973]). Since then more than 500,000 square feet of office space has been added in two large projects.

⁹ Reasons for industrial deconcentration in the Twin Cities area were comparable to those that were important in other areas. See "Industrial Expansion and Migration in the Twin Cities Metropolitan Area: 1960-1970" (Metropolitan Council, St. Paul, Minn., 1973); Muller, *op. cit.* [see footnote 1 above], pp. 32-35; and Brian J. L. Berry and Yehoshua S. Cohen: Decentralization of Commerce and Industry: The Restructuring of Metropolitan America, in *The Urbanization of the Suburbs* (edited by Louis S. Masotti and Jeffrey K. Hadden; Sage Publications, Beverly Hills, Calif., 1973), pp. 431-455.

and not preferred by commercial or speculative uses. Substantial new industrial construction occurred during all stages of development because metropolitan deconcentration of industrial and wholesale activities was relatively constant throughout the postwar period.

THE ROLE OF THE PUBLIC SECTOR

Suburban freeway corridors were primarily the products of decisions made by private developers. Governmental inputs were minor and indirect, except for the selection of freeway routes and the timing of their construction. Designation of the freeway routes preceded development in surrounding areas, so landowners withheld their property from the market until more intensive users entered the corridors. Conversion of land from residential to industrial and commercial uses was more difficult and more expensive in parts of metropolitan areas where planners were forced to run freeways through previously developed areas. The timing of freeway construction was also important. The earlier freeways were completed, the more diverse and greater the scale of adjacent development.

Direct governmental controls were generally responsive. Zoning ordinances usually were enacted to reflect existing land use patterns and to avoid future minor conflicts. Perhaps the most important public decisions that affected development in the I-494 corridor were municipal regulations concerning the sale of liquor for consumption on the premises. Of the three municipalities in the corridor, only Bloomington initially permitted the sale of liquor by the drink, and as a result, all large motor hotels and restaurants were built in that city. Local legal distinctions of a similar nature undoubtedly gave suburban freeway corridors in other metropolises their own unique characteristics.

A LOOK TO THE FUTURE

The forces that led to the rapid development of suburban freeway corridors have slackened and will probably not be duplicated in most American metropolises in the near future. A radical change in the metropolitan transportation network accompanied a rapidly dispersing population in the last quarter century. Commercial activities followed the population, and the new freeways provided ideal sites for industries and distributors seeking large parcels of cheap, accessible land. Corridor development was spurred further by speculative investments during the economic boom of the late 1960's.

Although population continues to disperse in metropolitan areas, the pace has slowed and the crests of the growth waves have passed the circumferential freeways. As nearby populations stabilize and decline, low-ordered functions will be hard-pressed to afford expensive SFC sites. Higher-quality, high-ordered functions will continue to congregate near major freeway interchanges, and low-overhead "bargain" establishments will market their used goods and seconds to a metropolis-wide clientele that will seek them out at less desirable corridor locations.

A repeat of the economic prosperity of the 1960's is unlikely, but SFC locations are still considered among the safest sites for speculative investment because raw land values for many parcels apparently will continue to appreciate rapidly. Fears have been expressed that overbuilding of office buildings and motor hotels will lead to excessive competition, declines in occupancy rates, reduced levels of service, and

economic instability.¹⁰ The uncertain future of these ventures is compounded by the fact that many structures were built primarily for later resale. The construction and maintenance quality of corridor office buildings and motor hotels appears to be much poorer than their older central city counterparts.

Planning and construction of the metropolitan freeway network has been completed in most metropolises, but light industries and distributors will continue to be attracted to accessible corridor locations where land lies vacant or awaits relatively inexpensive redevelopment. Expanding industrial and wholesale activity was a constant facet of corridor development and will be the backbone of most SFCs in the future. The advantages of corridor sites that originally attracted industrial users will remain, and the substantial capital investment in plants and warehouses ensures that the relative importance of manufacturing and wholesale uses in the corridors will increase.

The key to the future of suburban freeway corridors may be the relative ease of their redevelopment. The linear form of the corridors and the low density of development within them may make incremental redevelopment of sites much easier than in the central business districts. The SFCs do not exhibit the same degree of functional interdependence as the CBDs, however, and the relatively great distances separating corridor land uses make unlikely the enactment of comprehensive redevelopment programs such as those revitalizing some CBDs. The ultimate future of the SFCs, as was and is true of the CBDs, is tied to changes in metropolitan transportation systems. As long as traffic moves primarily in automobiles and trucks oriented to a freeway network, suburban freeway corridors are secure, but if and when transportation technology changes, they may become another albatross for the metropolis.

¹⁰ The corridor had more than 4,500 hotel rooms in 1973, more units than the Minneapolis and St. Paul CBDs combined ("The Hotel/Motel Industry in Bloomington" [Bloomington City Dept. of Community Development, Bloomington, Minn., 1974]). Occupancy rates that year were more than 75 percent, but the introduction of limited-service "budget" motels and the construction of major additions to existing hotels led to the prediction that occupancy rates would drop to approximately 50 percent by the end of the decade. Instead of achieving its desired role of becoming the "Anaheim of the North," some feared the corridor might become Minnesota's version of Orlando.

PLACES FOR MYSTERIES

DOUGLAS R. McMANIS

GABLED Victorian mansions, attractively proportioned Georgian houses, picturesque villages, London's chic West End, Soho's labyrinth of streets, narrow and winding rural roads and lanes, cliffed coasts, the British railway network, landscape changes wrought by the encroachments of developers, the engineered environment of the Fens—these are only a few of characteristics of places that a reader may encounter in British detective-mystery fiction. Although at first thought such fiction may not seem the place to look for the use of geography, mystery writing is an abundant source of literary geography. One may ask why geography is used, what its role is, and why geographers have ignored mystery fiction in their studies of literary landscapes.

The last question is the easiest to answer. The study of literary landscapes or of the use of geography in fiction writing has for the most part concentrated on "serious" literature and has left to comparative neglect writing that the arbiters of literary standards have decreed to be popular entertainment or escapist reading. Although the status of detective-mystery fiction is a matter of dispute, only rarely are examples of the genre categorized as a higher form of literature.¹ Nevertheless, the fact that a vast reading public is exposed to a host of geographical information from the detective-mystery genre makes it worthy of analysis for its geographical components.

To answer the questions of why geography is used and what its role is in the genre, I shall turn to the writings of two women who have been among the most popular of British fiction writers since the 1920's.² At a time when activities of women in creative and artistic endeavors are being stressed, the choice of the works of female authors here highlights the unique contribution of the sex to British detective-mystery fiction. The writers surveyed here are Dame Agatha Christie and Dorothy L. Sayers. They have been selected because of their familiarity to American readers and because of the quality of their novels, although aficionados of the genre may object to the exclusion of favorites such as Margery Allingham, Josephine Tey, Ngaio Marsh, Ruth Rendell, Elizabeth Lemarchand, or P. D. James. Dame Agatha is the most widely read of these writers. She enjoyed a long and prolific career that began in 1920, and posthumous volumes have been published since her death in 1976.³ Dorothy Sayers, in contrast, had a relatively short career as a writer of detective fiction, but she created a character who continues to captivate readers and to attract followers, as the recently televised versions of her novels attest.⁴

At the time Christie and Sayers began their careers, writers of mystery fiction were expected to use a format of prescribed traditions that had proved successful with

¹ Critical studies of mystery fiction include A. E. Murch: *The Development of the Detective Novel* (Kennikat Press, Port Washington, N.Y., 1968); and Julian Symons: *Bloody Murder: From the Detective Story to the Crime Novel: A History* (Faber and Faber, London, 1972).

² Julian Symons: *The Detective Story in Britain* (Longmans, Green and Co., London, 1962), p. 24.

³ Details on Christie's career are found in Jeffery Feinman: *The Mysterious World of Agatha Christie* (Award Books, New York, 1975); Nancy Blue Wynne: *An Agatha Christie Chronology* (Ace Books, New York, 1976); "Agatha Christie, Creator of Poirot, Dies," *New York Times*, Jan. 13, 1976; and "Dame Agatha, Queen of the Maze," *Time*, Jan. 26, 1976, p. 75.

⁴ Janet Hitchman: *Such a Strange Lady* (Avon Books, New York, 1976).

readers. The format included the usual components of fiction writing: plot, setting, and characters. The format required that the plot be an ingenious and often diverting puzzle, stressing how a crime was committed rather than why it was committed, as is the present mode of the genre. Convention decreed that a plot must have a setting as introductory background for a story and that the setting for a plot should be a fictionalized version of the real world milieus which characters would ordinarily frequent on the basis of their socioeconomic status. Ordinary places, not the unusual, the formidable, or the abstract, were the basic geography of the genre. As their careers progressed, Christie and Sayers broke with many of the early format restrictions and developed their own distinct writing styles. Each accepted the requirement to provide a setting and to have setting be an ordinary place, but neither agreed to the limitation that the setting should serve merely as the background for the story and not be too obtrusive in the development of a plot. Instead, the relationship between plot and setting was determined by the needs of each individual story.⁵

Mystery writing is a genre in which guidelines from literary discourse or analyses are few; successful and marketable products tend to set standards. Conan Doyle, one of the most important predecessors in the establishment of the genre's traditions, had his master detective state the rule of ubiquitous potential settings in "The Adventure of the Copper Beeches." Gazing from the window of a train as it rushed through the countryside, Sherlock Holmes remarked, "It is my belief, Watson, founded upon my experience, that the lowest and vilest alleys in London do not present a more dreadful record of sin than does the smiling and beautiful countryside."⁶ Later, a statement of the potential ubiquity of crime was uttered by Hercule Poirot, one of Dame Agatha's master sleuths, who observed that "there is evil everywhere under the sun."⁷ The dictum excluded very little of the world from being a setting for plots, as Dame Agatha herself stated in a prologue to one of her few adventure novels.

So, in a sense, you don't have to invent your settings. They are outside you, all around you, in existence—you have only to stretch out your hand and pick and choose. A railway train, a hospital, a London hotel, a Caribbean beach, a country village, a cocktail party, a girls' school.

But one thing only applies—they must be there—in existence. Real people, real places. A definite place in time and space.⁸

The role of the geographical setting as it is found in the writings of Christie and Sayers is threefold. The setting provided the place or places for the action of the plot. A locale for the crime was a *sine qua non* of the format. The mystery not only occurred under certain circumstances but also occurred somewhere. Hence the story must have a place or places where the crime was committed, discovered, and solved. The inherited format also required sketches or maps, and they are found in these authors' works in spite of their reputations as rebels against the format approach. Rebellion

⁵ Symons, *Detective Story* [see footnote 2 above], p. 27.

⁶ Arthur Conan Doyle: *The Complete Adventures and Memoirs of Sherlock Holmes* (Bramhall House, New York, 1975), p. 161.

⁷ Agatha Christie: *Evil under the Sun* (Pocket Books, New York, 1973 [originally published in 1941]), p. 14. Most of Christie's and Sayers's novels are available in paperback editions. Citations here will be to paperback editions when they are available, with the date of original publication in brackets.

⁸ Agatha Christie: *Passenger to Frankfurt* (Pocket Books, New York, 1974 [originally published in 1970]), p. viii.

may be observed in their varied treatment of the relationships between setting and story development. Sometimes the relationship was passive, in which case the setting was background only—a stage—for the plot and rarely mentioned once the story was under way.

When the relationship between plot and setting was active, two additional roles for the setting were used. The characteristics of place could be crucial to the commission of the crime and consequently to its solution. For example, in a plot where a large rolling boulder crushed and killed a person, the setting must include a physical environment with boulders and sufficient gradient for their movement, while the plot must provide a reasonable explanation for why the person was in that location. Or if foul weather was part of the circumstances surrounding a strange incident, the setting must be a locale where that type of weather occurred. Finally, the characteristics of place could be used as part of the puzzle that must be resolved in order to solve the crime. The elements of place in this usage were part of the diversions and misclues given by the author to make the solution of the crime more baffling, to demonstrate her ingenuity at plot construction, and to allow the reader who successfully recognized the diversionary elements the reward of "outguessing the author." For the reader the task then became not only to solve the murder but also to determine if a murder had been committed—was the body at the foot of the cliff the victim of murder or did the person accidentally slip?

DAME AGATHA CHRISTIE

As the more prolific of the two writers, Dame Agatha offers more examples of geographical interest. She has been described as the mistress of thumbnail characterization, a stylistic feature that applies to her settings as well as her characters and one that became more pronounced as her career progressed.⁹ Her earliest works followed the inherited format: "The Mysterious Affair at Styles" had many introductory pages to describe the setting—a large country house, its grounds, and surrounding area—and the requisite sketch of the house.¹⁰ But the stylistic rebel was present even in that early part of her career. In "The Man in the Brown Suit," at a point where many writers would show their skill in landscape description, Dame Agatha simply wrote that she would omit local color, a position remarkable not only for failing to take the opportunity to display a particular writing talent but also for a fledgling author's refusal to follow the accepted conventions.¹¹

Dame Agatha gave some insight into her definition of geography in the few passages where she specifically identified geographical items. From context it is apparent that she conceived of the field in an elementary manner that few geographers today would accept. She would indicate the layout of a place, its situation, and a few features that established the character of the place. A typical example of content, although it was longer than ones in later writings, is in "The Murder of Roger Ackroyd," a novel which ranks among her best and which established her reputation as one of the leading mystery writers of her time. She wrote,

⁹ Jacques Barzun and Wendell H. Taylor, eds.: *A Catalogue of Crime* (Harper & Row, New York, 1971), p. 116; and Murch, *op. cit.* [see footnote 1 above], p. 219.

¹⁰ Agatha Christie: *The Mysterious Affair at Styles* (Bantam Books, New York, 1974 [originally published in 1920]), pp. 1–22.

¹¹ Agatha Christie: *The Man in the Brown Suit* (Dell Publishing Co., New York, 1974 [originally published in 1924]), p. 107. She expressed the same position in her "Murder in Mesopotamia" (Dell Publishing Co., New York, 1976 [originally published in 1936]), p. 42.

It might be as well to give some idea of what I should describe as our local geography. Our village, King's Abbot, is, I imagine, very much like any other village. Our big town is Cranchester, nine miles away. We have a large railroad station, a small post office, and two rival "General Stores." Able-bodied men are apt to leave the place early in life, but we are rich in unmarried ladies and retired military officers. Our hobbies and recreations can be summed up in one word, "gossip."¹²

However, thirty years later, in "What Mrs. McGillicuddy Saw!" Dame Agatha offered a more restricting definition—geography as simple location. She had Miss Marple remark, "He knew—he must have known—all about Rutherford Hall—its geographical position, I mean its queer isolation: an island bounded by railway lines."¹³

Because of her terse but evocative descriptions and her limited definition of geography, the best way to understand Dame Agatha's use of geographical settings is to read a number of her novels. A reader sensitive to geographical concerns will identify several themes that she used repeatedly. Her settings were most frequently in Britain, and she showed a distinct preference for village-rural landscapes, although urban-suburban features were prominent in a number of novels—especially when Poirot, that most urban of detectives, was a character. Houses of various sizes, shapes, and styles dotted Christie's landscapes. Her native Devon was the only area that emerged as an identifiable region. Steep slopes and weather were the physical elements most often encountered. Change, usually for the worse, was a recurring theme best observed in her descriptions of the impact of urban expansion and the transformation of villages and large houses.

One wonders how many Americans have the image of an English village that is based on Christie's presentations of St. Mary Mead, the village of the sagacious Miss Marple. The village was introduced to readers at the same time as the masterful detective in "Murder at the Vicarage."¹⁴ A sketch showed the layout of its few structures and connecting roads and lanes. Around the village were open fields and woods. The village was to reappear in all the Miss Marple novels, with the exception of the last one. With each repeat something about it was different from earlier invocations. The processes of change affected the village and its surrounding area almost in the same way that the processes of aging slowly but surely took their toll on Miss Marple, both sets of processes being realities of the world from which Dame Agatha drew her inspiration. A quarter of a century after its introduction to readers, the village of St. Mary Mead showed most of the urban encroachments of post-World War II into rural Britain,¹⁵ although another village a comparable distance from London escaped them and displayed evidence of economic decline.¹⁶ As people moved

¹² Agatha Christie: *The Murder of Roger Ackroyd* (Pocket Books, New York, 1974 [originally published in 1926]), p. 5.

¹³ Agatha Christie: *What Mrs. McGillicuddy Saw!* (Pocket Books, New York, 1973 [originally published in 1957 as "The 4:50 from Paddington"]), p. 35.

¹⁴ Agatha Christie: *Murder at the Vicarage* (Dell Publishing Co., New York, 1974 [originally published in 1930]).

¹⁵ Agatha Christie: *At Bertram's Hotel* (Pocket Books, New York, 1974 [originally published in 1965]), p. 8; *idem*, *The Mirror Crack'd* (Pocket Books, New York, 1972 [originally published in 1962 as "The Mirror Crack'd from Side to Side"]), p. 3; and *idem*, *Nemesis* (Pocket Books, New York, 1973 [originally published in 1971]), p. 77.

¹⁶ Agatha Christie: *There Is a Tide* (Dell Publishing Co., New York, 1974 [originally published in 1948 as "Taken at the Tide"]), p. 19.

into St. Mary Mead, housing developments—public and private—arose, the village hall received an addition, and the shop fronts were modernized. The village also had the usual problem of the automobile age—car parking. In the last Miss Marple novel, “Sleeping Murder,” published posthumously but written in the early 1940’s, the aged sleuth ruminated on these changes as she saw them in a coastal resort rather than in her own village.¹⁷

Other villages appear in Dame Agatha’s work. They were small, usually consisting of a church, stores, and a few houses. Some had once been large and more important but had been bypassed by innovations in transportation.¹⁸ Out of the economic mainstream, they were places where odd things happened simply because eccentricity and other odd things were expected to occur in such quaint places.

“Third Girl” was one of Christie’s most urban novels, but it contained one of the most extensive descriptions of an English village to be found in Dame Agatha’s writing.

Hercule Poirot walked along the main street of Long Basing. That is, if you can describe as a main street a street that is to all intents and purposes the only street, which was the case in Long Basing. It was one of these villages that exhibit a tendency to length without breadth. It had an impressive church with a tall tower and a yew tree of elderly dignity in its churchyard. It had its full quota of village shops disclosing much variety. It had two antique shops, one mostly consisting of stripped pine chimney pieces, the other disclosing a full house of piled-up ancient maps, a good deal of porcelain, most of it chipped, some worm-eaten old oak chests, shelves of glass, some Victorian silver, all somewhat hampered in display by lack of space. There were two cafés, both rather nasty; there was a basket shop, quite delightful, with a large variety of homemade wares; there was a post office-cum-greengrocer; there was a draper’s which dealt largely in millinery, and also a shoe department for children and a large miscellaneous selection of haberdashery of all kinds. There was a stationery and newspaper shop which also dealt in tobacco and sweets. There was a wool shop which was clearly the aristocrat of the place. Two white-haired severe women were in charge of shelves and shelves of knitting materials of every description. Also large quantities of dressmaking patterns and knitting patterns and which branched off into a counter for art needlework. What had lately been the local grocer’s had now blossomed into calling itself “a supermarket,” complete with stacks of wire baskets and packaged materials of every cereal and cleaning material, all in dazzling paper boxes. And there was a small establishment with one small window with Lillah written across it in fancy letters, a fashion display of one French blouse, labeled “Latest chic,” and a navy skirt and a purple-striped jumper labeled “separates.” These were displayed by being flung down as by a careless hand in the window.

All of this Poirot observed with a detached interest. Also contained within the limits of the village and facing on the street were several small houses, old-fashioned in style, sometimes retaining Georgian purity, more often showing some signs of Victorian improvement as a veranda, bow window, or small conservatory. One or two houses had had a complete face lift and showed signs of claiming to be new and proud of it. There

¹⁷ Agatha Christie: *An Autobiography* (Dodd, Mead & Company, New York, 1977), p. 497; and *idem*, *Sleeping Murder* (Bantam Books, New York, 1977 [originally published in 1976]).

¹⁸ Agatha Christie: *By the Pricking of My Thumbs* (Pocket Books, New York, 1974 [originally published in 1968]), p. 70; *idem*, *The Moving Finger* (Dell Publishing Co., New York, 1975 [originally published in 1943]), p. 8; *idem*, *Murder in Three Acts* (Popular Library, New York, n.d. [originally published in 1935 as “Three-Act Tragedy”]), p. 144; and *idem*, *Poirot Loses a Client* (Dell Publishing Co., New York, 1976 [originally published in 1937 as “Dumb Witness”]), p. 23.

were also some delightful decrepit old-world cottages, some pretending to be a hundred or so years older than they were, others completely genuine, any added comforts of plumbing or such being carefully hidden from any casual glance.¹⁹

And why should Poirot, the resident of a chic modern London apartment, and savorer of Soho's culinary delicacies, be walking in a remote village? He had to absorb local atmosphere because it was important to the solution of the case at hand, as one would expect from the rules of the game.

What was perhaps Dame Agatha's most sensitive use of a rural setting was in "Endless Night," a novel that was atypical of her style in many ways, for its moody atmosphere suggested more the tradition of the gothic story than mystery fiction. The general locale was an isolated area within driving distance from London where a large tract, once the site of a grand estate but now vacant because the house burned, was for sale and about to be taken by developers. The estate site with its view of hills and moors was lonely but beautiful. The nearby village was "nice," but household help was difficult to attract and keep because it lacked suitable diversions.²⁰ The local squire was one of Christie's most sympathetic characters. He may appear to be a stereotype, but his conflict between love of his land and economic plight evokes sympathy. Like Christie, the squire too was an inheritor of traditions, but his in contemporary Britain did not lead to wealth. He combined a sense of duty and local patriotism. His attachment to the land—of which he owned considerable quantities—was of such magnitude that he refused to sell in spite of limited income from the holdings. More than one landowner in Britain understands and lives with such a quandary.

Christie's use of urban settings was dominated by London, the center of her British universe. She never made an effort to describe the entire gigantic metropolis; instead the focus was on small portions or elements. Its role as a transportation hub was perhaps the element most consistently treated, because her characters frequently moved about.²¹ The transportation system allowed her characters to move in and out of the city with ease—whether the journey was a weekend jaunt, a shopping trip from St. Mary Mead, a detective's pursuit of a case, or overseas trips. In her earlier works the London settings were usually the areas of the rich and upper-middle class or the buildings where Poirot lived and his haunts such as the then-numerous fine, small gourmet restaurants of Soho. Occasionally a plot required that someone stray into the less genteel areas of the city.²² In later novels the urban setting was both factual and nostalgic. The central geographical theme of "Third Girl" was the demand for personal space in London and the practice of "flatting" by young people to obtain it.²³ The same theme was found in "Hickory, Dickory, Death," where the setting was a student hostel, combining two once-attractive houses, in a seedy area of London that

¹⁹ Agatha Christie: *Third Girl* (Pocket Books, New York, 1973 [originally published in 1967]), pp. 23–24.

²⁰ Agatha Christie: *Endless Night* (Pocket Books, New York, 1973 [originally published in 1967]), p. 92.

²¹ Agatha Christie: *The ABC Murders* (Pocket Books, New York, 1974 [originally published in 1935]), p. 69; *idem*, *Death in the Air* (Popular Library, New York, n.d. [originally published in 1935 as "Death in the Clouds"]), pp. 7–8; *idem*, *An Overdose of Death* (Dell Publishing Co., New York, 1975 [originally published in 1940 as "One, Two, Buckle My Shoe"]), p. 27; *idem*, *Passenger to Frankfurt* [see footnote 8 above], pp. 5–6; *idem*, *Towards Zero* (Pocket Books, New York, 1974 [originally published in 1944]), p. 3; and *idem*, *What Mrs. McGillicuddy Saw!* [see footnote 13 above], pp. 1–2 and 12.

²² Agatha Christie: *The Big Four* (Dell Publishing Co., New York, 1973 [originally published in 1927]), p. 108; *idem*, *Mrs. McGinty's Dead* (Pocket Books, New York, 1973 [originally published in 1952 as "Blood Will Tell"]), pp. 1–2; and *idem*, *The Seven Dials Mystery* (Bantam Books, New York, 1973 [originally published in 1929]), pp. 33 and 38–39.

²³ Christie, *Third Girl* [see footnote 19 above], p. 14.

had been a superior neighborhood.²⁴ Miss Marple had the advantage of staying at a traditional British hotel that still gave service in the Edwardian manner, while she revisited scenes of her youth only to find the formerly grand houses divided into flats.²⁵ She balanced the bad aspects of urban life with the reminder of the cultural opportunities to be found in the city, even if she did not attend them. "The Pale Horse" used the bohemian aspects of Chelsea as its setting, but it again was in "Third Girl" that specifics of the area were given.²⁶ The street pattern from King's Road to the Thames was a "bewildering maze of streets," a terse description that could be applied to many areas of London. In a pre-World War II novel of no particular distinction, Dame Agatha offered antiurban sentiments. A visitor to London found it filled with "dirt, grime, and endless incessant crowds," words appropriate to many urban areas both before and after the war.²⁷

Three novels illustrate Dame Agatha's use of suburbs. The locale of the crime and its solution in "A Pocket Full of Rye" was a suburb of rich commuters having easy access via trains to London, and living in large, pretentious houses with affected names.²⁸ "The Clocks," in contrast, offered a commuter center of another vintage and for a different economic class. It was Victorian with architecture that had not yet been modernized, although the large houses along its principal shopping street had been changed into business units. Here Dame Agatha selected a crescent-shaped unit of attached houses and adjoining back gardens for the scene of the crime and for the factors of deception and solution.²⁹ The general locale of "Hallowe'en Party" was a new commuter community near London where a large Victorian house and the abandoned quarry on its grounds were the focus of the plot. In one of the few examples of radical landscape transformation to occur within the framework of a single novel, Dame Agatha described the change of the quarry into a sunken garden filled with rare plants and trees so that it reminded Poirot of the winding lanes of Devon and their banks of primroses.³⁰

Christie's penchant for houses became one of her trademarks, but her treatment of houses was different from that of a cultural geographer. In some stories the role of house was so significant to the plot that the house became part of the title.³¹ Few of her structures, however, received the description that was given to Styles, the scene of her first novel and of her penultimate one.³² With sufficient interval between novels, Dame Agatha documented the process of change to which the large houses had been subjected. One was sold by its squire owner to wealthy Americans; others changed

²⁴ Agatha Christie: *Hickory, Dickory, Death* (Pocket Books, New York, 1973 [originally published in 1955 as "Hickory, Dickory, Dock"]), pp. 2-3.

²⁵ Christie, *At Bertram's Hotel* [see footnote 15 above], pp. 75-76.

²⁶ Agatha Christie: *The Pale Horse* (Pocket Books, New York, 1973 [originally published in 1961]), p. 3; and *idem*, *Third Girl* [see footnote 19 above], p. 79.

²⁷ Agatha Christie: *A Holiday for Murder* (Bantam Books, New York, 1975 [originally published in 1938 as "Murder for Christmas"]), p. 1.

²⁸ Agatha Christie: *A Pocket Full of Rye* (Pocket Books, New York, 1973 [originally published in 1953]), p. 11.

²⁹ Agatha Christie: *The Clocks* (Pocket Books, New York, 1972 [originally published in 1963]), pp. 3-4.

³⁰ Agatha Christie: *Hallowe'en Party* (Pocket Books, New York, 1974 [originally published in 1969]), p. 72.

³¹ Agatha Christie: *Crooked House* (Pocket Books, New York, 1973 [originally published in 1949]); *idem*, *The Mysterious Affair at Styles* [see footnote 10 above]; *idem*, *The Pale Horse* [see footnote 26 above]; *idem*, *Peril at End House* (Pocket Books, New York, 1974 [originally published in 1932]); and *idem*, *The Secret of Chimneys* (Dell Publishing Co., New York, 1975 [originally published in 1925]).

³² Agatha Christie: *Curtain* (Pocket Books, New York, 1976 [originally published in 1975]); and *idem*, *The Mysterious Affair at Styles* [see footnote 10 above].

functions and were remodeled into hotels, hostels, or schools.³³ An exception occurred in "Dead Man's Folly," where a convenient marriage brought the money to keep a house and estate in a family for at least one more lifetime.³⁴

After the emergence of her terse style, Christie's focus often shifted from a description of the house to the mood that it evoked. She was apt to bring the reader to the door and usher him inside quickly with only the briefest mention of identifiable or distinguishing characteristics.³⁵ In "What Mrs. McGillicuddy Saw!" the location of the house was more important than the house itself, but the house was appropriately antiquated, a neglected "miniature Windsor Castle."³⁶ The hideousness of the exterior in "Crooked House," a Greek restaurateur's idea of something English, paralleled the condition of some occupants.³⁷ Likewise, End House was never described except to note that it was in bad repair, dreary, and isolated and that the house, standing alone on a cliff, was the sort of place where strange things could and did happen.³⁸ Christie's large houses usually had grounds and gardens, sometimes poorly kept because of changing economic conditions but always a reminder of the importance of these manicured elements in British landscapes.³⁹

Devon was the only region of Britain that took on something approaching a regional identity in the writings of Dame Agatha. The distinction was not so much because of the geographical quality of her writing as the use of place-name identification. In various works, the county's cliffs and resorts, its variable weather, grand houses, villages, and the like played their expected roles.⁴⁰ "Murder at Hazelmoor" was one of Christie's most geographical novels. It had two plots under way simultaneously, and geographical elements of the location overlooking Dartmoor were crucial to every significant development in each plot. Christie's battery of geography was well used as catalyst and mood in this novel: weather, villages, transportation network, terrain, cultural perception. Few of her plots were so totally interwoven with regional elements as in this book.⁴¹ Still something was missing. The locale was known to be

³³ Agatha Christie: *The Body in the Library* (Pocket Books, New York, 1973 [originally published in 1942]), p. 24; *idem*, *Cat among the Pigeons* (Pocket Books, New York, 1974 [originally published in 1959]), p. 1; *idem*, *Dead Man's Folly* (Pocket Books, New York, 1974 [originally published in 1956]), pp. 15-16 and 58; *idem*, *The Mirror Crack'd* [see footnote 15 above], p. 17.

³⁴ Christie, *Dead Man's Folly* [see footnote 33 above], p. 58.

³⁵ Agatha Christie: *Funerals Are Fatal* (Pocket Books, New York, 1972 [originally published in 1953 as "After the Funeral"]), p. 1; *idem*, *Murder after Hours* (Dell Publishing Co., New York, 1973 [originally published in 1946 as "The Hollow"]), p. 1; *idem*, *A Murder Is Announced* (Pocket Books, New York, 1974 [originally published in 1950]), p. 16; *idem*, *Murder with Mirrors* (Pocket Books, New York, 1973 [originally published in 1952]), pp. 16 and 21; *idem*, *Ordeal by Innocence* (Pocket Books, New York, 1974 [originally published in 1958]), p. 4; *idem*, *Postern of Fate* (Bantam Books, New York, 1974 [originally published in 1973]), p. 4; *idem*, *Remembered Death* (Pocket Books, New York, 1974 [originally published in 1945 as "Sparkling Cyanide"]), pp. 23 and 46; *idem*, *Sad Cypress* (Dell Publishing Co., New York, 1974 [originally published in 1940]), p. 20; *idem*, *Ten Little Indians* (Pocket Books, New York, 1975 [originally published in 1939 as "And Then There Were None"]), p. 9; and *idem*, *Thirteen at Dinner* (Dell Publishing Co., New York, 1976 [originally published in 1933 as "Lord Edgware Dies"]), p. 26.

³⁶ Christie, *What Mrs. McGillicuddy Saw!* [see footnote 13 above], p. 26.

³⁷ Christie, *Crooked House* [see footnote 31 above], pp. 18-19.

³⁸ Christie, *Peril at End House* [see footnote 31 above], pp. 7 and 17.

³⁹ Christie, *A Holiday for Murder* [see footnote 27 above], p. 11; *idem*, *Murder after Hours* [see footnote 35 above], pp. 11 and 90-91; *idem*, *A Murder Is Announced* [see footnote 35 above], p. 47; *idem*, *Nemesis* [see footnote 15 above], p. 79; *idem*, *Poirot Loses a Client* [see footnote 18 above], p. 52; *idem*, *Sad Cypress* [see footnote 35 above], p. 33; and *idem*, *What Mrs. McGillicuddy Saw!* [see footnote 13 above], p. 26.

⁴⁰ Christie, *The Big Four* [see footnote 22 above], pp. 27-28; *idem*, *Dead Man's Folly* [see footnote 33 above]; *idem*, *Evil under the Sun* [see footnote 7 above]; *idem*, *Murder in Three Acts* [see footnote 18 above]; and *idem*, *Ten Little Indians* [see footnote 35 above].

⁴¹ Agatha Christie: *Murder at Hazelmoor* (Dell Publishing Co., New York, 1973 [originally published in 1931 as "The Sittaford Mystery"]).

Devon because of the place-names rather than the description. A composite of her other "Devon" novels would reveal the same outcome—the sum of the parts did not add up to a regional whole.

Terrain and weather were the physical elements most frequently encountered in Christie's plots. Long before Christie started her career, writers of mystery fiction had learned the versatility of steep gradients in plots. A slip of the foot on a wet path, a momentary loss of balance, a rolling rock, a quick shove—explanations for a body at the end of a long steep grade are numerous. Christie continued the tradition and provided many plots where steep slopes were essential and where happenings on them were important aspects of the puzzle surrounding a crime. She also recognized that gradients with caves provided more opportunities to complicate the puzzle.⁴²

In "Murder at Hazelmoor" an unusually heavy snowfall and the consequent isolation of the area were keys to both plots. What was an inconvenience to some was a joy to others. One group of characters, supposedly visitors from South Africa, was enchanted "with the idea of an old-fashioned Christmas with snow and ice."⁴³ Weather was also used to create the mood for the plot. In "Evil under the Sun" resort-type weather attracted the characters to the scene of the crime and contrasted with the tragedy of murder.⁴⁴ Christie was not above using the stereotype role of weather to portend ominous, mysterious happenings. The British winter frequently served as the reason to get characters out of Britain into foreign areas. Persons wealthy or fortunate enough to be able to escape the dreary season went abroad and provided a logical explanation for the selection of foreign settings such as the French Riviera, Egypt, or a Caribbean resort island.

Foreign settings were used in several novels, but for the most part these settings provided only passive background, regardless of the evocativeness of Christie's description. They were the stage for the plot, essential for mood but rarely contributing to development. Her autobiography revealed the extent to which she drew upon her own travels outside Great Britain for information.⁴⁵ She traveled on the Orient Express, and in time the experience provided the backdrop for one of her most popular novels. The novel, however, is more concerned with events within a coach than the landscape visible from the window. In "Murder on the Orient Express" geography made logical the snow in which the train stalled, but the reader must resort to place-names to determine where in Yugoslavia the climax of the novel occurred.⁴⁶ A similar geographical detachment marked "Death on the Nile."⁴⁷ Locations were specifically identified; the antiquities of Egypt were described in detail. But

⁴² Agatha Christie: *Boomerang Clue* (Dodd, Mead & Company, New York, 1968 [originally published in 1934 as "Why Didn't They Ask Evans?"]), p. 10; *idem*, *Elephants Can Remember* (Dell Publishing Co., New York, 1973 [originally published in 1972]), p. 15; *idem*, *Evil under the Sun* [see footnote 7 above], pp. 25, 28, 37, and 118–119; *idem*, *Murder at Hazelmoor* [see footnote 41 above], p. 218; *idem*, *N or M?* (Dell Publishing Co., New York, 1974 [originally published in 1941]), pp. 37–38 and 62; *idem*, *Nemesis* [see footnote 15 above], p. 95; *idem*, *The Secret Adversary* (Bantam Books, New York, 1975 [originally published in 1922]), p. 123; and *idem*, *Towards Zero* [see footnote 21 above], pp. 6 and 27.

⁴³ Christie, *Murder at Hazelmoor* [see footnote 41 above], pp. 7, 26, 56, and 113.

⁴⁴ Christie, *Evil under the Sun* [see footnote 7 above], pp. 8, 43, and 47.

⁴⁵ Christie, *The Big Four* [see footnote 22 above], p. 103; *idem*, *A Caribbean Mystery* (Pocket Books, New York, 1974 [originally published in 1965]), p. 14; *idem*, *The Man in the Brown Suit* [see footnote 11 above], p. 44; and *idem*, *The Mystery of the Blue Train* (Pocket Books, New York, 1974 [originally published in 1928]), pp. 58 and 82.

⁴⁶ Agatha Christie: *Murder on the Orient Express* (Pocket Books, New York, 1974 [originally published in 1934 as "Murder on the Calais Coach"]), p. 28.

⁴⁷ Agatha Christie: *Death on the Nile* (Bantam Books, New York, 1973 [originally published in 1937]).

creation of a mood was lacking. The cruise could have been up the Thames and the plot used without alteration. Likewise, in "They Came to Baghdad" the setting was a detached stage with other plot elements supplying the mood for the story. In general Christie's style, so effective for plots in her native England, failed to evoke exotic sites or situations.⁴⁸

The exceptions were "Appointment with Death" and "So Many Steps to Death." In the former, Christie's detailed descriptions of the ruins of Petra and her use of them in the plot approached the level of geographical treatment found in "Murder at Hazelmoor."⁴⁹ The repeated mention of the starkness and lack of habitation that characterize the North African desert created the desolate isolation essential for the mood of "So Many Steps to Death," an example of the effective use of geography in an otherwise undistinguished novel.⁵⁰

Geographical features in the novels of Dame Agatha Christie were many and varied. She generally used geography to provide a setting for each plot, but in some instances she extended the role to other purposes such as mood or occurrence of the crime. The British landscape was the principal source of her geography—a real world that she fictionalized in her stories. An overview of her many novels reveals that landscape change through time was her most consistent geographical theme. Her treatment of geographical elements became one aspect of terse style. Because she was a very individualistic writer, her treatment of geography should not be assumed to be either the standard or the stereotype for the genre. The mystery genre is a versatile and adaptable medium, capable of accommodating varied talents and styles. Stylistic preference as the basis for differing treatments of geographical components may be illustrated by contrasts between the writings of Dame Agatha and novels of Dorothy L. Sayers, who likewise drew her geography from the contemporary British landscape.

DOROTHY L. SAYERS

During the 1920's and 1930's Dorothy L. Sayers was a formidable challenger to Christie for the position of first lady of British mystery writing. Sayers wrote much less than her contemporary, but she created a master detective, Lord Peter Wimsey, who captured the imagination of a wide reading public and who continues to intrigue readers within and outside Britain. Readers tend to become so involved with Wimsey as a character that the mystery aspects of plots sometimes become secondary interests. Sayers herself provided the example. "Busman's Honeymoon," her final Wimsey novel, was subtitled "A Love Story with Detective Implications."⁵¹ Wimsey was something of an anachronism when he was created—the charming younger son of a British duke with sufficient funds from undisclosed sources to indulge his eccentricities and hobbies, including playing detective.⁵² He was a symbol of a way of life that

⁴⁸ Barzun and Taylor, *op. cit.* [see footnote 9 above], p. 118. Readers may observe in Agatha Christie: *Death Comes as the End* (Pocket Books, New York, 1972 [originally published in 1945]) that a chronological setting in ancient Egypt, not geography, provided the mood for the novel.

⁴⁹ Agatha Christie: *Appointment with Death* (Dell Publishing Co., New York, 1975 [originally published in 1938]), pp. 61, 63, 65, and 66.

⁵⁰ Agatha Christie: *So Many Steps to Death* (Pocket Books, New York, 1973 [originally published in 1954 as "Destination Unknown"]), pp. 70–71, 73, and 78.

⁵¹ Dorothy L. Sayers: *Busman's Honeymoon* (Avon Books, New York, 1968 [originally published in 1937]), title page.

⁵² Hitchman, *op. cit.* [see footnote 4 above], p. 76.

economic toil and redistribution of wealth have ended in Britain. The settings of the Wimsey novels were the milieus in which a person of his status and inclinations would have moved. Many of them are also gone, victims of the processes of change so often mentioned in Christie's work but absent from Sayers's.

Sayers shared many characteristics of the mystery genre with Dame Agatha but had a different prose style. Sayers was more concerned with how a crime was committed than why it was committed. She created a master detective, ingenious in his solution of baffling mysteries, be they violent crimes or lesser illegal happenings. She accepted the axiom that plots should reflect the real world, however romantically she distorted it, and she consequently chose settings that were identifiable. But the scale and content of a setting changed from novel to novel. Her settings ranged from single structures, usually interiors, that provided a social milieu rather than a geographical one to regions whose geographical characteristics were used throughout the plot. From the beginning of her career Sayers rejected the format of a mandatory introductory description of the setting. Although she sometimes made use of the format, more typical of her style was the introduction of setting components at phases when the items were functionally necessary to the action of the plot. On the other hand, she followed contemporary dictates by including sketches or maps to show settings or aspects of them.⁶³ Her treatment of settings was made possible by her writing style, for her plots and novels were longer and more involved than those of Dame Agatha. The greater length allowed her to expand characterization and description of people and places. Terseness was never her hallmark, and her prose tended to be comparable with the contemporary fiction styles rather than with the pithy prose of Christie.

Sayers typically began her novels with scenes that established characterization or provided indications of the plot to be unfolded. Sometimes these scenes contained geographical elements, but more often they did not. As a novel developed, Sayers presented the necessary geographical elements in two ways. One was the injection of brief passages at appropriate and critical phases of the plot. These were scattered throughout a novel so that a reader was never too far from the geographical milieu, however much her style kept it in the background. An example of the critical placement style was in "Unnatural Death." At a time when the identity of the criminal was known but proof for arrest was lacking, Sayers moved the novel to its conclusion by providing the proof. As she built the tension of the situation, she introduced a passage that described the area where it was occurring. The short passage, although it was the longest specifically geographical one in the novel, was effective because it added mood to the story and halted the action only briefly.

Shelly Head lies about ten miles along the coast from Crow's Beach, and is curiously lonely, considering how near it lies to the water-place. Under the cliffs is a long stretch of clear sandy beach, never visited, and overlooked by no houses. The cliffs themselves are chalk, and covered with short turf, running back into a wide expanse of downs, covered with gorse and heather. Then comes a belt of pine-trees beyond which is a steep, narrow and rutty road, leading at length into the tarmac high-road between Ramborough and Ryders Heath. The downs are by no means frequented, though there are plenty of rough tracks which a car can follow, if you are not particular about comfort or fussy over your springs.⁶⁴

⁶³ Dorothy L. Sayers: *Five Red Herrings* (Avon Books, New York, 1968 [originally published in 1931]), p. 8; and *idem*, *Unnatural Death* (Avon Books, New York, 1964 [originally published in 1927]), p. 102.

⁶⁴ Sayers, *Unnatural Death* [see footnote 53 above], pp. 193-194.

Elsewhere placement of even briefer passages or phrases—such as mention of weather, soot drifting in a window, a bustling railway station, or an apartment complex—sufficed to create a sense of place, where longer passages would break the flow of action.⁶⁵ These phrases evoked more than the words said.

In some novels, particularly "Five Red Herrings," "Gaudy Night," "Murder Must Advertise," and "The Nine Tailors," interaction between characters and setting was varied and extended throughout the novel.⁶⁶ Elements of setting that in composite formed the milieu for each novel were thus found on many pages, in passages from a colorful verbal palette. "Five Red Herrings" offers numerous examples of integration of plot and geographical setting. The book, however, is one of her least read. The use of Scottish dialect gives considerable local color and authenticity to the story, but it also makes the book very difficult to read. The setting was an artist colony-tourist resort on the southwestern coast of Scotland. Most of the painters were landscapists, drawn to an area that was relatively untouched by urbanization and industrialization and that abounded with features attractive to landscape painters as well as urban vacationers. Landscape elements played a crucial role in the development of the plot and thus were interwoven throughout the story. Here was Sayers's only use of the old stand-by of mystery writers—a fall down a steep slope for the commission of the crime.⁶⁷ Fishing was an alternative occupation for residents, illegal for some and the basis of one alibi. Abandoned mines from an earlier era provided the alibi for yet another suspect. Movement into, out of, and within the region by means of roads and railways was the key to Wimsey's unraveling of the mystery. The following passage illustrates Sayers's descriptive style and demonstrates how skillfully she mixed local geography and the requirements of the plot. Wimsey was driving from the village to the scene of the crime.

He passed through Gatehouse, waving a cheerful hand to the proprietor of Anwoth Hotel, climbing up beneath the grim blackness of Cardoness Castle, drank in for the thousandth time the strange, Japanese beauty of Mossyard Farm, set like a red jewel under its tufted trees on the blue sea's rim, and the Italian loveliness of Kirkdale, with its fringe of thin and twisted trees and the blue Wigtownshire coast gleaming across the bay. Then the old Border keep of Barholm, surrounded by whitewashed farm buildings; then a sudden gleam of bright grass, like a lawn in Avalon, under the shade of heavy trees. The wild garlic was over now, but the scent of it seemed still to hang about the place in memory, filling it with the shudder of vampire wings and memories of the darker side of Border history. Then the old granite crushing-mill on its white jetty, surrounded by great clouds of stone-dust, with a derrick sprawled across the sky and a tug riding at anchor. Then the salmon-nets and the wide semicircular sweep of the bay, rosy every summer with sea-pinks, purple-brown with the mud of the estuary, majestic with the hump of Cairnsmuir rising darkly over Creetown.⁶⁸

The description of Kirkcudbright by Sayers was so realistic that after publication of the book visitors demanded to be shown the site where the body was found, lapses

⁶⁵ Dorothy L. Sayers: *Gaudy Night* (Avon Books, New York, 1968 [originally published in 1935]), p. 184; *idem*, *Unnatural Death* [see footnote 53 above], pp. 94-96; and *idem*, *Whose Body?* (Avon Books, New York, 1961 [originally published in 1923]), pp. 16, 153, and 160.

⁶⁶ Sayers, *Five Red Herrings* [see footnote 53 above]; *idem*, *Gaudy Night* [see footnote 55 above]; *idem*, *Murder Must Advertise* (Avon Books, New York, 1967 [originally published in 1933]); and *idem*, *The Nine Tailors* (Harbrace Paperback Library, New York, n.d. [originally published in 1934]).

⁶⁷ Sayers, *Five Red Herrings* [see footnote 53 above], p. 18.

⁶⁸ *Ibid.*, p. 19.

from reality not being sufficient to ask where Lord Peter stayed. Not surprising, for as Sayers admitted the book had "a plot invented to fit a real locality."⁸⁹

Wimsey displayed aristocratic adaptability and was equally at ease in urban or rural settings. But his creator was more generous with descriptions of rural environs than of urban ones. "Clouds of Witness," the second Wimsey novel, had a picaresque format with the action of the plot shifting among urban and rural places. Yet it was a rural setting on the northern moors where the mystery occurred that brought forth the most direct use of geography in the novel. The hunting lodge, the neighboring farms, and other features of the locale were detailed. It was the moors on which Sayers lavished her words; she, like many other British writers, evidently could not resist testing her ability to capture the moody landscape in prose.

Behind Riddlesdale Lodge the moor stretched starkly away and upward. The heather was brown and wet, and the little streams had no colour in them. It was six o'clock, but there was no sunset. Only a paleness had moved behind the thick sky from east to west all day. . . . The path was marked with stout white posts at regular intervals, and presently with hurdles. The reason for this was apparent as one came to the bottom of the valley, for only a few yards on the left began the stretch of rough reedy tussocks, with slobbering black bog between them, in which anything heavier than a water-wagtail would speedily suffer change into a succession of little bubbles. Wimsey stooped for an empty sardine-tin which lay horridly battered, at his feet, and slung it idly into the quag. It struck the surface with a noise like a wet kiss, and vanished instantly.⁹⁰

However effective a description of the moor landscape the passage may be, at the risk of revealing the plot it must be noted that Wimsey's traverse contributed nothing to the resolution of the mystery. But the episode did show his doggedness and bravery, so that the literary consequence was a demonstration of the use of a geographical element to bring out characterization and as part of an increasingly complicated puzzle for readers.

The use of setting in "Have His Carcase" was more traditional. A coastal hotel, the kind once popular with the British middle class or those with pretensions to that class, and the surrounding environs of farms and pleasant lanes for solitary walks were the setting of the seventh Wimsey novel. Like most other British writers of mystery fiction of her era Sayers was attracted to resort settings. In this novel she was indeed traditional, for she provided an introductory description of the area that set forth early in the novel the geographical elements of importance and that allowed her once again to display her talents as a landscape descriptionist.

On the morning of the 18th June, she [Harriet Vane] set out from Lesston Hoe with the intention of walking along the coast to Wilvercombe, sixteen miles away. Not that she particularly looked forward to Wilvercombe, with its seasonal population of old ladies and invalids and its subdued attempts at gay life, seeming somehow themselves all a little invalid and old-ladyish. But the town made a convenient objective, and one could always choose some more rural spot for a night's lodging. The coast-road ran pleasantly at the top of a low range of cliffs, from which she could look down upon the long yellow stretch of the beach, broken here and there by scattered rocks, which rose successively, glistening in the sunlight, from the reluctant and withdrawing tide.

⁸⁹ Quoted in Hitchman, *op. cit.* [see footnote 4 above], p. 87.

⁹⁰ Dorothy L. Sayers: *Clouds of Witness* (Avon Books, New York, 1966 [originally published in 1926]), p. 71.

Overhead the sky arched up to an immense dome of blue, just fretted here and there with faint white clouds, very high and filmy. The wind blew from the west, very softly, though the weather-wise might have detected in it a tendency to freshen. The road, narrow and in poor repair, was almost deserted, all the heavy traffic passing by the wider arterial road which ran importantly inland from town to town, despising the windings of the coast with its few scattered hamlets. Here and there a drover passed her with his dog, man and beast alike indifferent and preoccupied; here and there a couple of horses out at grass lifted shy and foolish eyes to look after her; here and there a herd of cows, rasping their jawbones upon a stone wall, greeted her with heavy snuffings. From time to time the white sail of a fishing-boat broke the horizon. Except for an occasional tradesman's van, or a dilapidated Morris, and the intermittent appearance of white smoke from a distant railway-engine, the landscape was as rural and solitary as it might have been two hundred years before.⁶¹

The bucolic, arcadian tranquility—such a contrast to the noisy, busy, confused urban life left behind—nevertheless was disturbed by a body hidden among the rocks at the foot of the cliff. The dramatic contrast between the serenity and peace of the setting and the horrible violence of crime perhaps is the answer to the mystery writer's penchant for rural resort settings.

Economic dependency of rural areas on urban ones was a geographical theme in the "rural" novels of Sayers. The transportation network was, of course, at the heart of the interregional relationships. Markets for the art and the illegally caught fish of Kirkcudbright in "Five Red Herrings" were in London and Glasgow. Patrons of the resort in this novel, as well as in "Have His Carcase," came from urban places. House renters such as Wimsey and bride in "Busman's Honeymoon" likewise were urbanites.⁶² Although the transportation system was more than adequate to maintain interregional ties, Sayers considered certain parts of the British road system to be less than satisfactory for the machines driven on them. Still, their rough condition was insufficient to stop the movement of people or goods.⁶³

Urban settings predominate in five Wimsey novels. Sayers's treatment of these settings was unvaried. Not one was given the expanded portrayal that she allowed for rural settings. She made no attempt to depict the urban environment as a totality. Instead, her focus was on particular features that established where the mystery occurred and conjured a sense of place rather than a full-blown image or reproduction of it. In "Whose Body?" characteristics of the setting were conveyed to readers by notice of socioeconomic features such as occupations and social activities rather than explicit description of the professional, middle-class residential area, although a rooftop view of a group of apartments and an adjacent hospital had to be specified because of plot requirements.⁶⁴ A comparable stress on social milieu marked the setting of "The Unpleasantness at the Bellona Club."⁶⁵ In "Gaudy Night," "Murder Must Advertise," and "Strong Poison" interiors were the primary settings, and Sayers effectively depicted them as settings—a college at Oxford, a business firm, a court room, and the visitors' room of a prison, but little was done with the exterior

⁶¹ Dorothy L. Sayers: *Have His Carcase* (Avon Books, New York, 1968 [originally published in 1932]), pp. 9–10.

⁶² Sayers, *Busman's Honeymoon* [see footnote 31 above], p. 30.

⁶³ Sayers, *Have His Carcase* [see footnote 61 above], p. 10; and *idem*, *Unnatural Death* [see footnote 53 above], p. 115.

⁶⁴ Sayers, *Whose Body?* [see footnote 55 above], p. 64.

⁶⁵ Dorothy L. Sayers: *The Unpleasantness at the Bellona Club* (Avon Books, New York, 1963 [originally published in 1928]), pp. 9, 13, and 48.

milieus. Interiors in London and Paris that appeared in "Clouds of Witness" received the same treatment; their locations in those cities were known only by place-names, and any mood or atmosphere that the individual urban setting could have supplied was omitted. If one may allow Sayers novelistic license for her general reluctance to use her prose on urban geography, her ignoring of the city of Oxford in "Gaudy Night" must nevertheless be singled out for disappointment. The city, which by the time Sayers was writing had become an unusual juxtaposition of traditional, cloistered academe and modern industry, was worthy of her geographical treatment.

Wimsey resided on Picadilly, then a fashionable address of the titled, the wealthy, and royalty.⁶⁶ The Duke and Duchess of York (later King George VI and Queen Elizabeth) would have been his neighbors, and The Albany is still one of the premier addresses in London. Yet Sayers did little with the area, except to imply its social prestige. She perhaps assumed that some elements of the urban environment were so familiar to readers that brief exposition sufficed. In contrast, she did highlight the ease with which her characters moved about London, chiefly by taxi, as one would expect of the social class.⁶⁷ As in Christie's works, Sayers made much use of the fact that London was the hub of the British transportation system and consequently had road and railway access throughout the country. Sayers introduced air traffic into her transport-communication system by having Wimsey perform a feat à la Lindbergh's Atlantic flight.⁶⁸

"The Nine Tailors" deserves special consideration in any study of geography in the writing of Dorothy Sayers. This novel had an integration of plot and setting not to be found in her other works. Considered by some to be her best novel, "The Nine Tailors" combined Wimsey, campanology, and plot features unusual to the mystery genre.⁶⁹ In this type of fiction the primary function of plot is to present a mystery and its solution; issues of punishment and reparation may be implicit but are usually left to readers' speculations. However, in "The Nine Tailors" solution of the mystery shared focus in the plot with these issues. Around them the climax of the novel was organized, and Sayers selected the forces of nature to be the agency of judgment.

The novel ranks as one of the outstanding regional mystery novels. The setting was the Fens, an area that has been extensively studied by geographers, and readers would do well to peruse important pieces of geographical literature in order to experience firsthand the different treatment and emphases that a novelist on one hand and professional scholars on the other bring to portrayal of a region.⁷⁰

Geographical elements opened the story. Hazardous driving conditions and an unusually heavy snowfall had interrupted Wimsey's journey, thus placing him in the small village where the bulk of the action occurred. Dikes, ditches, and drains received early mention, so that the dominant physical features of the area's geography were put immediately before the reader. The lay of the land, the clustering of buildings on high ground, the village centered on a Norman church, the intricate network of drainage, and a close-by estate that, before World War I, had seen more

⁶⁶ Sayers, *Whose Body?* [see footnote 55 above], p. 7.

⁶⁷ Dorothy L. Sayers: *Strong Poison* (Avon Books, New York, 1967 [originally published in 1930]), pp. 14 and 45; and *idem*, *The Unpleasantness at the Bellona Club* [see footnote 65 above], pp. 45 and 58.

⁶⁸ Sayers, *Clouds of Witness* [see footnote 60 above], p. 192.

⁶⁹ Hitchman, *op. cit.* [see footnote 4 above], p. 97.

⁷⁰ H. C. Darby: *The Draining of the Fens* (2nd edit.; Cambridge Univ. Press, Cambridge, 1956); and J. R. Ravensdale: *Liable to Floods: Village Landscape on the Edge of the Fens A.D. 450-1850* (Cambridge Univ. Press, Cambridge, 1974).

affluent times were the main geographical elements blended with dramatic purpose in the development of the story.

By naming imaginary governmental agencies, Sayers reminded readers that the setting was a managed landscape in which man must constantly be at work to maintain his transformation of the physical environment. Floods were a persistent problem in the area, and the climax of "The Nine Tailors" occurred during an inundation that followed the heavy snowfall. Significantly, the climax phase of the plot dealt not with the solution of a crime but with moral reparation. The scene took its mood from the man-land relationships of the region. Sayers's imagery was obviously biblical. The village church on high ground was the ark of refuge for the surrounding population as the waters rose. By that point in the development of the novel illegal happenings were replaced as the focus of the plot by a more serious, unintentional moral offense. The terror and devastation of the flood were balanced by the opportunity it offered to do good and heroic deeds for one's fellow men in the hope of divine and human absolution. The morally guilty person did the deeds and was swept into the redemptive waters in a passage that was suggestive of the use of the Rhine in the finale of Wagner's "Die Götterdämmerung." When the swirling waters finally receded, the devastated land awaited repair, and the pursuit of life continued without the biblical promise that the flood would not be revisited. Sayers chose the smell of the refuse to convey the impact of devastation to readers.

"The odour," observed Bunter, gazing out on the twentieth day across the dismal strand of ooze and weed that had once been Fenchurch St. Paul, "is intensely disagreeable, my lord, and I should be inclined to consider it insanitary."

"Nonsense, Bunter," said his master. "At Southend you call it ozone and pay a pound a sniff for it."

The women of the village looked rueful at the thought of the cleaning and drying that their homes would need, and the men shook their heads over the damage to rick and barn.⁷¹

The Fens landscape that Sayers used so effectively in "The Nine Tailors" was familiar to her, for she spent her childhood there, at Bluntisham Rectory, Huntingdonshire.⁷² In contrast with Christie, who made frequent use of her natal Devon as a setting for novels, Sayers used her childhood home only once as a principal setting. From the memories of childhood came one of the most dramatic, cohesive literary landscapes to be found in British mystery writing.

Verisimilitude adjusted to the dramatics of arcane happenings has long been one of the distinguishing features of British mystery writing, and its practitioners have written many descriptive, evocative passages on British geography. However, presentation of geography in the genre is varied, the result of personal writing styles. Christie and Sayers inherited the tradition of verisimilitude and applied it consistently but individualistically to their choice of settings. Thus their novels, like those of other writers of the genre, provide not only the enjoyment that comes from reading mysteries but also a kaleidoscope of the literary geography of Great Britain.

⁷¹ Sayers, *The Nine Tailors* [see footnote 56 above], pp. 308-309.

⁷² Hitchman, *op. cit.* [see footnote 4 above], p. 21.

ETHNIC MAPS OF NORTH AMERICA*

KARL B. RAITZ

ONE of the objectives of social science in general, and cultural geography in particular, has been to evaluate the distribution of culture groups as a step toward understanding the processes that have produced distinct cultural milieus in the United States and Canada. One of the most important tools developed to study this facet of culture is the ethnic map. In this paper I will discuss the methods used to map American cultural or ethnic groups at several scales. The review is not intended to be exhaustive, because a number of maps have been made using similar techniques and information sources and repetition would be of little value. Nor is it comprehensive, because the volume of maps, if one includes those that often accompany specialized studies in urban sociology or anthropology, is substantial. I will confine my comments to maps that represent methodological prototypes, to those that indicate major trends in ethnic research, and to those that represent the only detailed large-scale map available for the area covered.

NATIONAL-SCALE MAPS

For many American geographers who wrote in the early decades of the twentieth century, the single most important aspect of the population geography of the United States was the distributional pattern of immigrants. Because many geographers assumed that the foreign-born were gradually being assimilated into the mainstream of American life, early geographical studies focused less on the cultural diversity of the immigrants than on the ecological relationships between the environments of their homelands and those of the sites chosen for settlement in the New World, or on the strategic location of certain port cities as entry points for immigrants and the development of migration routes to the interior. To the compilers of the federal census and to geographers, the millions of Europeans and Asians who had left their homelands to find jobs, to flee from political or religious oppression, or to obtain land for the first time in their families' history were aliens, immigrants, or the foreign-born. They were not ethnics. The term ethnicity, which ascribes to an individual or group the qualities of a distinct culture based on shared heritage and values, has been part of the geographer's research vocabulary only since the 1930's and 1940's, when it was developed as an explanatory concept in sociology for certain kinds of group behavior.¹

The maps that the previous generation of geographers used to portray immigrant distributions at the national scale were invariably based on census materials. Ellen Semple, writing in 1903, included a map of the "Foreign" in "American History and Its Geographic Conditions."² The map was based on county data for foreign-born from the eleventh national census of population. The foreign-born were mapped in six proportional categories of foreign to the total population. County boundaries were used to delimit intervals in the eastern half of the country, whereas a number of boundaries in the West were generalized. Semple's explanation for the small number of scattered immigrant settlements in the South, which she thought to be the most striking feature on the map, was "the presence of that most alien of all aliens, the negro

* I would like to thank Professor Terry G. Jordan, Dept. of Geography, North Texas State University, for his comments on an earlier draft of this paper.

¹ One of the most applicable and widely accepted definitions of ethnicity is that of Gordon, who states, in essence, that the ethnic group is a group with a shared feeling of peoplehood (Milton M. Gordon: *Assimilation in American Life* [Oxford Univ. Press, New York, 1964], pp. 24-30).

² Ellen Churchill Semple: *American History and Its Geographic Conditions* (Houghton, Mifflin, and Co., Boston, 1903), foldout map inserted between pages 312 and 313.

[sic]."³ What Semple's map does not reveal—nor do any other maps of this period that were based on data on the foreign-born—are distinctive culture groups in southeastern Pennsylvania, southern Louisiana, or northern New Mexico. The Pennsylvania Dutch, the Cajuns, and the old Spanish settlements in the Rio Arriba country had been in place for several generations, but they were not classified as foreign-born or as second-generation immigrants by the census even though they retained a distinctive language, religion, and culture. We should not view this as an oversight because from the context of the map in a chapter on immigration, it is clear that Semple's primary concern was to explain the distribution and assimilation of recent immigrants.

In some scholarly works, maps of immigrant populations were used to illustrate arguments for establishing and maintaining strict controls over immigration. A. P. Brigham, for example, in his book on "The United States of America," included a chapter entitled "The Racial Composition," in which he argued that the 13.5 million foreign-born whites did not constitute a population large enough to "hopelessly alienize" the country.⁴ But he did note, with an unsuppressed air of relief, that it was "appalling to imagine what the number might have become in a few years had no checks arisen."⁵ Brigham's map of foreign-born whites was not intended to be a tool for analysis of settlement, as Semple's was, but to illustrate where the concentrations of intruders were and, consequently, where efforts to "Americanize" the alien elements should be intensified. The map is a simple one showing the proportion of foreign-born to total population in each state. Heavy black line patterns were used to depict proportions in the three highest categories, perhaps to achieve maximum psychological impact on the reader.

In the 1920's and 1930's a number of ethnic studies focused on human ecology and on the problems of the adaptation of the immigrant to the American environment. The best collection of national-scale ethnic maps published during this period appeared in Charles O. Paullin and John K. Wright's "Atlas of the Historical Geography of the United States."⁶ A benchmark work of its day, the atlas contains two sets of small-scale maps illustrating the distribution of European immigrants: one set shows the total foreign-born population for 1860, 1880, 1900, and 1930, the other, population born in Germany, Ireland, and Norway-Sweden for 1880, 1900, and 1930. These three groups were chosen for study because "their representatives in the U.S. are numerous and well distributed and tend to preserve their stock characteristics and to form distinct political and social classes. No other stocks satisfy equally well these conditions."⁷ The small-scale maps do illustrate gross distributional patterns, but the method of selection of the three groups is somewhat curious. Apparently the authors believed that those groups which were "well distributed" and still in possession of a certain amount of their Old World character would have the most regional significance. But a strong case could be made that a number of eastern and southern European groups exhibited more cultural resilience at the time than those mapped. A second problem with the maps is that foreign-born were shown in absolute numbers per county instead of as a ratio to the total population. The result is that there is no way to differentiate counties with large total populations and a small proportion of immigrants from those in which immigrants comprise a large segment of the total population.⁸

Richard Hartshorne, the first geographer to consider the geographical effects of the presence and distribution of racial minorities in the United States, included detailed maps of Negroes, Mexicans, Indians, and Orientals, the "colored races" as he termed them, in his paper on "Racial Maps of the United States." Hartshorne saw the large black population in the South as "the single most important factor in the geography of the region," but he was

³ *Ibid.*, pp. 312-313.

⁴ A. P. Brigham: *The United States of America* (Burt Franklin, New York, 1927), p. 90.

⁵ *Ibid.*, p. 88.

⁶ Charles O. Paullin and John K. Wright: *Atlas of the Historical Geography of the United States* (Carnegie Inst. and the Amer. Geogr. Soc., Washington, D.C., and New York, 1932), pp. 46-47.

⁷ *Ibid.*, p. 47.

⁸ *Ibid.*

equally concerned about the impact of unassimilated minorities on the social and political geography of the other regions of the country. His choropleth maps of Negroes, Mexicans, Indians, and Orientals were based on county data from the 1930 federal census. He also included six dot maps, based on the same data source, comparing the distributions of Negroes, Mexicans, Indians, Japanese, Chinese, and Filipinos in the states of Washington, Oregon, and California.⁹

More recently, Wilbur Zelinsky mapped several ethnic groups using not one data source, but several. In his review of the major processes that influenced the regional distribution of twelve major ethnic groups in the United States, Zelinsky included a set of eight national-scale ethnic maps, "all . . . highly schematic in character" and based on both absolute and relative data values and differing definitions of ethnicity.¹⁰ The regional concentration of six groups was so pronounced that he was able to show two groups on each of the three maps with virtually no conflict in patterns. The rural concentrations of the Spanish-Americans and the Irish, for example, do not appear to overlap one another at any point. Although, as Zelinsky cautioned, the reader should not make quantitative comparisons between his maps—a task that would be somewhat difficult because he included only primary and secondary concentrations as quantitative categories—the maps have considerable heuristic value.

The ethnic map of southern Canada and the United States in the Soviet "Atlas Narodov Mira" is different from the types discussed to this point.¹¹ Although neither the full Russian text nor the abbreviated English translation reveals the data source for the map, or the rest of the atlas maps for that matter, it was probably based on a variety of sources, including both census and linguistic data. Instead of illustrating either ethnic or linguistic groups, the authors intermixed the two classifications.¹² For example, both the Negro and the English are shown as distinct linguistic groups in the United States. The map was printed in ten colors at a scale of 1:12,000,000. Fifty-four "linguistic" groups, twenty-two of which are Indian, are represented by solid colors or patterns, and minorities are indicated by color symbols. Although the map is impressive at first glance, questions about method or purpose arise as one studies the patterns in detail. Symbols that represent minority populations are placed in general proximity to the actual location of the group, but no indication of symbol value or proportion is given for either minority or mixed areas, as in much of the South, where Negroes and Americans are shown as a mixed population with no suggestion of proportion. Numerous inconsistencies and omissions occur in important regional groupings. Indianapolis is shown as having a significant German minority, but Cincinnati, one of the most German of midwestern cities, is shown as having none. The French-speaking area of Louisiana is clustered around Lafayette but is smaller than it should be. Missing from the maps are groups such as the Texas Germans, the Kansas Swedes, and the Japanese of San Francisco. No European groups at all are shown in the Dakotas or Nebraska.

A further inconsistency in the "Atlas Narodov Mira" is its treatment of Indian groups in Canada and the United States. In Canada the "Ojibwa" are shown as a minority group spread evenly across northern Ontario, and the Crees occupy northern Quebec. Because of the apparent density of the symbols the two groups appear to be equal to one another, and both appear to be greater in number than the Scandinavian population in the Upper Midwest. Yet

⁹ Richard Hartshorne: *Racial Maps of the United States*, *Geogr. Rev.*, Vol. 28, 1938, pp. 276-288, reference on p. 284.

¹⁰ Wilbur Zelinsky: *The Cultural Geography of the United States* (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1973), pp. 30-31.

¹¹ S. I. Bruk and V. S. Apenchenko, eds.: *Atlas Narodov Mira* (Main Administration of Geodesy and Cartography, Moscow, 1964), pp. 94-95.

¹² In another publication (*Basic Methodological Problems in Ethnic Mapping*, *Soviet Geogr.*, Vol. 3, 1962, pp. 32-34) S. I. Bruk discusses methodological problems in ethnic mapping. He states that the ethnic maps published in the Soviet Union use an ethnolinguistic classification of groups, based on the Marxist-Leninist view of national communities, which makes it possible to show the proximity between related peoples. Western maps, he contends, commonly are based on a mixed anthropological-linguistic classification in which the ethnic composition of areas is distorted.

the Indian population in Ontario in 1963, a year before the atlas was published, was 47,260 and in Quebec only 23,043.¹³ Moreover, many Quebec Indians lived on or near reservations, which totaled only 118,000 acres. In the United States, by contrast, all Indians are shown as concentrated on reservations. Indians in Minneapolis, in the larger cities of the Southwest, or in Appalachian North Carolina are not shown; nor are Pueblo Indians along the Rio Grande included. The Indian population patterns in Canada are generally the same as those mapped by Alfred Kroeber, whereas the Indians in the United States appear to have been mapped by reservation.¹⁴

MEDIUM-SCALE SECTIONAL, STATE, AND REGIONAL MAPS

Macroethnic studies that cover large areas provide useful insights into the broad questions of settlement sequence and distribution, but the specific implications of the historic processes of migration, invasion, and succession of urban residential areas, and the problems of assimilation and ethnic spatial behavior, are more appropriately addressed through more specific data sources and at a subnational scale.

Mapping ethnic groups at the state or regional scale for the purpose of analyzing distributions as they relate to the sequence of migration, open land, or the settlement frontier began in the second decade of the twentieth century and is represented by Guy-Harold Smith's studies of Germans and Scandinavians in Wisconsin.¹⁵ To demonstrate the value of the Wisconsin state census, which was taken midway between the federal decennial censuses, for such studies, Smith mapped the distribution of the German-born and Scandinavian-born in the state as of 1905. Unlike the federal census, in which data on foreign-born were available only by county, the state census published data by township and minor civil divisions. Dots were used to plot the rural population and graduated circles the urban areas. Smith was able to locate quite precisely the most densely settled foreign-born communities. He found that few areas in the state had homogeneous ethnic settlements that encompassed an area larger than a township (36 square miles). The largest and most homogeneous settlements were usually settled by chain migration to preselected areas—a process that occupied relatively large acreages of land in a short period but precluded other immigrant groups from gaining a foothold in the same area, thereby fostering the continuity of cultural traditions.

In numerous studies conducted in the 1930's, sociologists at the University of Wisconsin found that social and economic behavior differed from one locality to another or even varied within localities in an irregular manner in which the only valid explanations seemed to relate to nationality. These studies were among the first to deal with the effects of ethnicity or distinct cultural heritage of first- and second-generation immigrants. George Hill found that variations in per-acre loan value of farmland and tenancy patterns, for example, could not be explained by covariation in either physical or economic factors. The explanation of the anomalies seemed to lie in differences between ethnic settlements or, as Hill termed them, "culture areas." Although Hill did not believe that ethnicity or nationality was synonymous with culture, he did believe that if a group identified with a nationality they thereby provided substantial evidence that they were culturally distinct. In the American context, different nationalities tended to develop certain social values and attitudes peculiarly their own. These values and attitudes tended to crystallize into social heritages, Hill thought, and then to condition the behavior of nationality

¹³ *Canada Year Book, 1970-1971*, p. 245.

¹⁴ A. L. Kroeber: *Cultural and Natural Areas of Native North America* (Univ. of California Press, Berkeley, 1963), map in pocket entitled "Native Tribes of North America."

¹⁵ Guy-Harold Smith: *Notes on the Distribution of German-Born in Wisconsin in 1905, Wisconsin Mag. of History*, Vol. 13, 1929, pp. 107-120; and *idem*, *Notes on the Distribution of Foreign-Born Scandinavian Population in Wisconsin in 1905, ibid.*, Vol. 14, 1931, pp. 419-431. See also Eugene Van Cleef: *The Finn in America, Geogr. Rev.*, Vol. 6, 1918, pp. 185-214. Using 1910 census data Van Cleef mapped absolute numbers of Finns, Finns as a proportion of total foreign white stock by state, and absolute numbers by country for the North Central states.

groups in their new cultural settings.¹⁶ To evaluate the importance of cultural groups as a factor in explaining behavior patterns, Hill made an ethnic map of the state of Wisconsin.¹⁷ Casting about for an appropriate data source for the map, he found the federal census of little value because all nationality data were published at the county level, and because he had found in earlier studies that characteristics of social status varied more from township to township within counties than between counties, he concluded that the township was the best unit for his purpose.

The problem was rectified to Hill's satisfaction by using the same state census manuscripts for 1905 that Smith had used ten years earlier. Information on nationality from some 400,000 manuscript schedules representing a population of about 2,000,000 was tabulated by Hill and his co-workers and recorded on a township base map. The result was a color map on a scale of approximately 1:1,390,000. Twenty-three nationality groups were shown. Across broad areas township boundaries were used to delimit groups. Where no single nationality group was dominant—that is, 80 percent or more—Hill termed the area interstitial and mapped it as "mixed." He was concerned that the thirty-five-year-old data were not an accurate reflection of the contemporary groups he was studying and that the persistence of nationality groups was not sufficiently great to warrant the use of 1905 census materials to map them. Through fieldwork, however, he found a great deal of persistence in the location of most nationality groups between the tabulation of the census and 1941, when the paper in which he described the methodology used in making the map was published. With the exception of the Czechs and Poles, who had expanded at the expense of their neighbors, ethnic groups were located much as they had been in 1905. With such a map in hand, Hill argued, one could either study the relationship between ethnicity and factors such as migration, fertility, or diffusion, or compare several settlements of the same group in order to evaluate the significance of related factors such as religious preference.

In 1943 a rural sociologist, Nathan Whetten, and a social science specialist for the U. S. Department of Agriculture, Henry Riecken, published two maps of the foreign-born population of Connecticut. The color maps, published at a scale of about 1:845,000, were "designed to be of service to research workers in problems of population and race and cultural relations" and were based on special tabulations from the 1940 federal census and on published bulletins from the 1930 census. One map shows eleven dominant groups in the total foreign-born population of each town; the other shows dominant groups in the rural farm foreign-born population. Whetten and Riecken defined dominance as 18 percent or more foreign-born in a town. At first glance the maps are somewhat misleading because dominance here referred only to foreign-born groups, when in reality, the native-born population dominated in all towns. The foreign-born in Connecticut numbered about 328,000 in 1940, or just over 19 percent of the population, and more than half lived in cities of 25,000 or more, about the same proportion as the total population. Especially striking were numerous "islands," as Whetten and Riecken called them, of nationality groups in rural areas.¹⁸ Finns, French-Canadians, Russians, Poles, Germans, Swedes, and others had apparently settled in homogeneous communities across the state.

¹⁶ George W. Hill: The Use of the Culture-Area Concept in Social Research, *Amer. Journ. Sociol.*, Vol. 47, 1941, pp. 39-47, reference on p. 43.

¹⁷ Hill's map is published in "The People of Wisconsin According to Ethnic Stocks, 1940," in Wisconsin's Changing Population, *Bull. Univ. of Wisconsin, Ser. No. 2642*, Madison, 1942. See also Einar Haugen: The Norwegian Language in America: A Study in Bilingual Behavior (2nd edit.; 2 vols.; Indiana Univ. Press, Bloomington, 1969). Haugen used Hill's Wisconsin map as a basis for his Norwegian settlement map of the state (vol. 1, p. 29).

¹⁸ Nathan L. Whetten and Henry W. Riecken, Jr.: The Foreign-Born Population of Connecticut, 1940, *Univ. of Connecticut, Storrs Agric. Experiment Stn., Bull. 246*, 1943, pp. 1-75, reference on p. 17. The maps are inserted between pages 16 and 17 and between pages 32 and 33. Included in the bulletin are a number of smaller maps of individual groups and 1930 foreign-born groups as well as numerous graphs and tables. For an updated collection of maps of Connecticut's ethnic population based on 1970 U.S. Census fourth count summary tape data, see Thomas E. Steahr: Ethnic Atlas of Connecticut: 1970 (Amer. Revolution Bicentennial Commission of Conn., Hartford, 1976).

Three years after the publication of the Connecticut map, another rural sociologist, J. F. Thaden, published a map of "The Farm People of Michigan According to Ethnic Stocks: 1945."¹⁹ The map was intended as a tool in Thaden's studies of the traits and characteristics of "transplanted Europeans." Thaden gathered information for the map in three phases.²⁰ First he obtained specially transcribed data from the federal census on foreign-born whites, by country of birth, for each rural county. Then he conducted interviews throughout the state with local officials and community leaders who were familiar with the national origins of the farm families in their areas. Last, he examined a form entitled "The Census Field Sheet and Family Record" used by the county school commissioners in several hundred school districts. The form records the country of birth of parents having children of school age. Most school districts covered four square miles, and they included an average of twenty-three families. The finished map, which shows Upper Michigan in an offset, has a scale of approximately 1:824,000. Thaden mapped twenty-six different ethnic groups, including Canadians, Mexicans, Negroes, and Indians, four groups that Hill did not include on his Wisconsin map. Because his map was intended to reflect the status of the farm population, Thaden chose to leave blank the cities and land areas with a sparse rural population. Like Hill and Whetten, Thaden used township lines as convenient group boundaries in Lower Michigan, but he also recorded dozens of much smaller settlements. In Upper Michigan the settlement boundaries became much more interpretative, in part, perhaps, because of the lack of standard township boundaries. Upper Peninsula townships are a mixture of odd shapes and sizes, some quite large. Even here, though, he mapped a number of subtownship groups. Although the map was made using methods and data sources quite different from those used by Hill for Wisconsin, the two maps show a high level of correspondence in the distribution of ethnic settlements along their common border between the Upper Peninsula and northern Wisconsin.

The wartime interest of rural sociologists in the assimilation of European immigrant groups is reflected in the publication of ten ethnic maps of Rhode Island by W. R. Gordon and A. A. Asadorian in 1946. Using as a data source a 1936 Rhode Island Department of Labor inter-decennial census, Gordon and Asadorian analyzed about 90,000 returns that listed race and country of origin. Unfortunately the authors chose to cluster "like" countries together, so the map of Swedes also includes the Finns, Danes, and Norwegians. This device was also used for Belgians, Austrians, Germans, and Swiss, and yet English and Scottish appear on different maps. A further difficulty with the maps, if one discounts problems inherent in placing dots in odd-shaped towns, is that male heads of household were mapped in absolute numbers so the map reader has no idea whether the proportion of the ethnic population to the total is high or low.²¹

In 1949 Douglas Marshall, then a rural sociologist at the University of Minnesota, published an ethnic map of Minnesota in the *Minneapolis Tribune*.²² Marshall did not include a statement of purpose or method with this map, but his writing elsewhere suggests an interest in the persistence of ethnic residence and in the spatial expansion or contraction of ethnic settlements through changes in landownership.²³ To obtain information for the map it is likely that Marshall conducted extensive field interviews with knowledgeable citizens and officials, espe-

¹⁹ J. F. Thaden: *The Farm People of Michigan According to Ethnic Stock: 1945*, *Michigan State Coll., Agric. Experiment Stn., Sec. of Sociol. and Anthropol.*, 1946.

²⁰ For an explanation of the method used to make the map see J. F. Thaden: *Ethnic Settlements in Rural Michigan*, *Michigan State Coll., Agric. Experiment Stn., Quart. Bull.*, Vol. 29, 1946, pp. 102-111, reference on pp. 109-110.

²¹ W. R. Gordon and A. A. Asadorian: *New Americans in Rural Rhode Island*, *Rhode Island Agric. Experiment Stn., Bull.* 298, 1946, reference on pp. 26-27.

²² Douglas Marshall: *Minnesota's People*, *Minneapolis Tribune*, Aug. 28, 1949, Part 4, p. 1.

²³ Marian Deiniger and Douglas Marshall: *A Study of Land Ownership by Ethnic Groups from Frontier Times to the Present in a Marginal Farming Area in Minnesota*, *Land Economics*, Vol. 31, 1955, pp. 351-360.

cially county extension agents.²⁴ He also probably used both the federal census materials for 1860 through 1880 and the Minnesota state census for 1895 and 1905, from which he classified surnames by ethnic categories.

The scale of Marshall's map is approximately 1 : 1,715,000. Twenty-two different nationality groups are shown, plus four categories of group combinations such as "Norwegian-Swedish," and "Finn-Scandinavian." A separate symbol was used where no single group was predominant, and although Marshall did not state the level of concentration he required to constitute predominance, the large areas covered by that symbol suggests that the level was at least as high as that used by Hill for the Wisconsin map, 80 percent or higher. Township and county boundaries appear to have been convenient dividing lines between groups in numerous places but not everywhere, because a large number of settlements much smaller in size than a township were also mapped.

Marshall's methods would not seem to produce the detail or accuracy of either Thaden's map or Hill's map, yet there is general correspondence of ethnic settlements between the Wisconsin map and Marshall's Minnesota map along their common border. The Mississippi and St. Croix rivers were the main avenues of immigration into southern Minnesota and western Wisconsin in the mid-1800's. Although they functioned as travel routes, the rivers can also be expected to have acted as a major divide between the two states as groups of immigrants chose to settle first on one bank and then on the other, as landing points, open land, or other factors such as roads into the back country dictated. But a comparison of ethnic settlements along this boundary shows that a number of groups apparently settled on both sides of the river.²⁵

To produce his well-known ethnic map of Texas, Terry Jordan compiled information from a wide variety of sources.²⁶ As a data base he used the federal censuses of 1910 (the first census to enumerate the native-born children of immigrants on a county basis) and of 1930. He also found that materials available from church groups were valuable in locating ethnic settlements. For example, handbooks from those churches with predominantly German-American memberships, such as the American Lutheran, United Lutheran, and Church of the Brethren, were used to outline the extent of many German settlements. Jordan was able to augment these sources and materials from fraternal organizations with information from numerous county and local histories. Finally, with a rough map of gross patterns of ethnic settlement in hand, Jordan verified his information in the field with cemetery and mailbox name counts, interviews, and letters to editors of county newspapers. The final four-color map has a scale of 1 : 1,500,000 and includes thirteen ethnic groups. In deciding which settlements warranted a place on the map, Jordan believed that "the population in question had to have the feeling of belonging to a particular group and live in close proximity to other members of the group to result in the presence of a community."²⁷ These criteria for identifying an ethnic group closely parallel Milton M. Gordon's definition of ethnicity.²⁸ Included on the map is a notation on mother colonies and their date of establishment. With the completed map Jordan was able to study the significance of ethnic groups in shaping the character of rural areas. When he compared his ethnic map to other maps, for example, he noted that the Germans had traditionally voted Republican whereas the Democratic party dominated politics elsewhere, and that whereas those with European and Spanish surnames did not uphold prohibition, precincts marked by Old Stock Americans did.

²⁴ Letter, Douglas Marshall to Karl Raitz, Mar. 5, 1976.

²⁵ Jordan and Rowntree included an ethnic map of this border zone based on the maps of Hill and Marshall in their textbook (Terry G. Jordan and Lester Rowntree: *The Human Mosaic* [Canfield Press, San Francisco, 1976], p. 197).

²⁶ Terry G. Jordan: *Population Origin Groups in Rural Texas*, *Annals Assn. of Amer. Geogr.*, Vol. 60, 1970, pp. 404-405, and Map Supplement No. 13.

²⁷ *Ibid.*, p. 404.

²⁸ Gordon, *op. cit.* [see footnote 1 above], p. 24-30.

A map of the ethnic population southwest of the Missouri River in North Dakota was prepared by William Sherman, a rural sociologist, in 1965.²⁹ The rationale for making the map was similar to that stated by Hill and by Thaden. In his experience with a number of research projects on the northern Great Plains, Sherman found that ethnicity seemed to be an important factor in the variations he observed in patterns of mental health, educational performance, mobility, and religious and political behavior.³⁰ In trying to ascertain the national background of the population over wide areas from the federal census he came up against the problems of county-sized data units and a lack of consistent or meaningful definitions of groups or subgroups, the same problems that others who have attempted to map ethnic groups have encountered. The data source that Sherman finally found suitable to his purposes was a master list of all North Dakota rural property owners, including both rural-farm and rural-nonfarm residents, which was based on the 1965 county treasury tax lists. Names were listed according to township, range, and section, making it possible to locate residences on a map to the square mile. Only two groups were excluded from the tax records: migrant workers and those living on Indian reservations. The latter were identified by special fieldwork. With the tax list in hand, Sherman visited knowledgeable residents in each county and in the major towns to establish the national origin of the names on the tax list. People in retirement homes proved to be especially valuable in identifying the nationality of names. Questionable names were identified by extended field interviews. Using the plots of the individual names on a base map, Sherman delineated seven major groups: German-Russian, German-Hungarian, German, Bohemian, Ukrainian, Norwegian, and Anglo-Saxon. In addition, he identified forty-three mixed areas by a code number keyed to the legend in which he described the proportion of each group. For example, one area in Adams County is listed as 35 percent Norwegian, 35 percent Anglo-Saxon, and 30 percent German-Russian.

The finished map, illustrated with black and white symbol patterns, has a scale of approximately 1:1,000,000. With the exception of those areas bordering the Indian reservations, distributions have not been generalized along township or county boundaries. In identifying the nationality of surnames, Sherman was able to differentiate minorities within nationality groups, such as the German-Hungarians and Ukrainians, that collectively occupy about a third of the mapped area. These groups would probably have been generalized as Germans or Russians had the data source been a census.

Although Sherman's use of surnames to map ethnic groups is a novel approach to the problem of finding an appropriate data source, it is not unique. One of the first studies to attempt to establish the validity of using surnames or family names from manuscript census materials as a surrogate for information on place of birth or mother tongue as a measure of national heritage was undertaken by the American Council of Learned Societies' Committee on Linguistic and National Stocks in the Population of the United States.³¹ The committee, staffed by a group of prominent social scientists, was to provide an accurate estimate of the proportion of various national and linguistic groups in the United States population in 1790. The purpose of the study was to provide a realistic basis for immigrant quotas, which had been based on the estimated numbers of each group in the country as of the first census. The committee concluded that surnames could, if carefully studied, give a reasonably reliable count of persons of foreign heritage. In 1966 the "American Heritage Pictorial Atlas of United States History" was published and included a map of the colonies titled "National Origin and Religion, 1790."³² The information for the map was probably drawn from the detailed descriptions of

²⁹ William C. Sherman: *Ethnic Population Distribution—Southwest Section of North Dakota*, 1965 (Dept. of Sociology-Anthropology, North Dakota State Univ.). I am indebted to John C. Hudson for informing me of the existence of this map and for putting me in contact with Professor Sherman.

³⁰ Letter, William Sherman to Karl Raitz, Feb. 17, 1976.

³¹ *Amer. Hist. Assn., Ann. Rept.*, 1931, Vol. 1, Proceedings (Washington, D.C., 1932), p. 103.

³² "The American Heritage Pictorial Atlas of United States History" (American Heritage Publishing Co., New York, 1966), p. 87.

ethnic distributions provided by the Committee on Linguistic and National Stocks.³³ The map shows the distribution of six national origin groups: English, Scotch-Irish, German, Scotch, Dutch, and African (subdivided into free Negroes and slaves).

A decade after the Committee on Linguistic and National Stocks completed its analysis of surnames, Peveril Meigs published a paper in which he used surnames to delimit French Louisiana. Because the federal census did not include information on such long-standing culture groups as the Louisiana French, Meigs calculated the proportion of Creole and Acadian French surnames that occurred in a list of the ten most common names in the telephone directories of 121 communities in Louisiana and Texas. He was able to delimit a core area extending northwest along Bayou LaFourche and the Atchafalaya River to Avoyelles Parish, 160 miles from the Gulf of Mexico, in which all names were French. The areas with less than 50 percent French names were not included in the French region. Indeed, Meigs found that beyond that boundary there were comparatively few French names.³⁴

In a study of the transfer of cultural traits from Finland to Minnesota, Matti Kaups found that place-names could be used as an indicator of early permanent residence but not of transitory settlement.³⁵ A map of foreign-born Finns in Minnesota, based on the 1905 state census, shows the distribution to be strongly associated with iron mining and lumbering in the Arrowhead region. These were to be only temporary occupations, however, because the Finns gradually moved out of the mines and lumber towns to buy adjacent forest land which they cleared for farming. Finnish place-names were not bestowed on the streets or parks of the mining towns but, as Kaup's maps reveal, generally appear in the concentrated enclaves that developed nearby. Kaups found that the changes which occur in names as they are anglicized by succeeding occupants or generations beg caution in their use as an index to ethnic settlement. He also found that although Finnish names occurred only in those areas which Finns occupied in relatively large numbers for long periods, not all settlements where they constituted a large majority had Finnish place-names.

For his study of five sectarian groups that occupy large land tracts in Canada's Prairie Provinces, C. A. Dawson drew information from the census of Canada, from the *Canada Year Book*, and from documents provided by church and fraternal organizations of the groups themselves to map the locations of twenty-nine "foreign groups" which "still retain to some extent their old-world practices and languages."³⁶ Though this map is small scale, about 1:12,600,000, each group settlement is legible and, given the relationship between the settlement and boundary lines or rivers, could probably be located on larger-scale maps without major difficulty. Each section of the book includes additional maps derived from census materials and fieldwork. Part Two, for example, entitled "The Mennonites," includes a map of the "Rural Population of Dutch Origin, 1921" (the Dutch were mapped because most of the Dutch foreign-born in the Prairie Provinces were Mennonites) that was obtained from a statistical atlas published by the Canadian government, a large-scale map of Mennonite landownership in the Western Reserve in southern Manitoba, a map of existing and defunct farm villages, a large-scale map of isolated farmsteads and farm villages, and a plan of the Mennonite community of Winkler.³⁷

³³ See Wilbur Zelinsky's comment on this point in "Cultural Variation in Personal Name Patterns in the Eastern United States," *Annals Assn. of Amer. Geogrs.*, Vol. 60, 1970, pp. 743-769, reference on p. 747.

³⁴ Peveril Meigs, 3rd: An Ethno-Telephonic Survey of French Louisiana, *Annals Assn. of Amer. Geogrs.*, Vol. 31, 1941, pp. 243-250, reference on p. 244. More recently John Fraser Hart commented on the strong association between surnames and ethnic identity among the Amish. He mapped the land owned by Amish in two counties in southwestern Iowa and northeastern Indiana by shading the areas owned by persons with characteristic Amish names. John Fraser Hart: *The Look of the Land* (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1975), pp. 18-19.

³⁵ Matti Kaups: Finnish Place Names in Minnesota: A Study in Cultural Transfer, *Geogr. Rev.*, Vol. 56, 1966, pp. 377-397.

³⁶ C. A. Dawson: Group Settlement: Ethnic Communities in Western Canada (MacMillan Company of Canada, Ltd., Toronto, 1936), p. iii.

³⁷ *Ibid.*, pp. 95-171.

An observation which comes to mind after a careful study of the maps throughout Dawson's book is that sectarian groups that wish to avoid contact with Old Stock Canadians and Americans and thereby reduce the rate of assimilation into those groups seem to have controlled large blocks of territory as a defensive measure. But territorial isolation is not the only way of avoiding assimilation. One of the most salient cultural characteristics that differentiates an immigrant from the host population is language. For the immigrant who wishes to become an active participant in the host society as quickly as possible, learning the language is of fundamental importance, for it provides the basic mode of communication through which interaction with the host society will take place. If an immigrant group wishes to avoid rapid assimilation they will attempt to settle in homogeneous groups and to maintain their own language and institutions.³⁸

One cannot assume that assimilation is a binary choice of either fully assimilating into the host or dominant culture by casting aside Old World values and culture traits or retaining the full content of one's culture and resisting assimilation, as Roman Cybriwsky has pointed out.³⁹ Instead, a wide range of adjustments are possible. Some immigrant groups were willing to take at least a limited part in the process of cultural assimilation but were determined to retain their ethnic identity by maintaining their language. Therefore the degree to which language is retained is a measure of ethnic identity as well as an indicator of cultural assimilation.

As a research tool for the study of linguistic assimilation, J. Neale Carman produced an historical and statistical atlas of the foreign-language-speaking residents of Kansas.⁴⁰ The atlas represents a monumental research effort that took ten years to complete. Hundreds of informants and extensive field studies produced detailed information on place of origin, settlement date, size, and many other bits of information on 500 major foreign-language settlements. The atlas includes maps of each large village and town and of foreign-language churches, a stylized state map of the spatial extent of the settlements of six predominant groups (Germans, Scandinavians, Slavs, Welsh, French, and Dutch), and, perhaps the most valuable, individual county maps showing the distribution of landholdings by language group. The nationality of landholders was determined by checking the orthography of surnames in plat books and the names of foreign-born from state census manuscripts and church documents, and by conducting a large number of field interviews. Groups that already spoke English when they arrived in Kansas were assumed to have been linguistically assimilated and were not mapped. As the county maps were completed, Carman established the chronology in which foreign-language speakers evolved through bilingualism to speaking English exclusively. For each settlement mapped, he included the estimated date at which the foreign language was no longer habitually spoken in the home. The dates range from the 1890's in some settlements to the 1930's or 1940's in others, with the only sharp transition occurring during World War I when public opinion encouraged many Germans to speak English.

Recently, as a further addition to the literature on the spread of the "German tongue in the world," Heinz Kloss completed an atlas of nineteenth- and early twentieth-century German-American settlements.⁴¹ The maps are organized into two sections. A statistical section includes three series of maps of each state showing German foreign stock, and an organization section is made up of nine series of maps that show church and fraternal club memberships by state and urban areas. The statistical series are based on the native language of the foreign-

³⁸ *Ibid.*, p. xv.

³⁹ Roman A. Cybriwsky: *Patterns of Mother Tongue Retention among Several Selected Ethnic Groups in Western Canada*, *Papers in Geography No. 5*, Dept. of Geography, Pennsylvania State Univ., University Park, 1970, pp. 3-4.

⁴⁰ J. Neale Carman: *Foreign-Language Units of Kansas*, Vol. 1. *Historical Atlas and Statistics* (Univ. of Kansas Press, Lawrence, 1962). Also, see Homer E. Socolofsky and Huber Self: *Historical Atlas of Kansas* (Univ. of Oklahoma Press, Norman, 1972). Their map of "Group Colonization in Kansas" is based on Carman's map of linguistic groups. Boundary symbols outline areas of concentration and separate Catholic and Protestant German groups.

⁴¹ Heinz Kloss: *Atlas of 19th and Early 20th Century German-American Settlements* (N. G. Elwert Verlag, Druck, 1974), p. 1.

born. Each state map shows both German-born population totals and the German population as a proportion of the total population by county. Especially valuable are the organization map series. Because the census did not list German ethnics living outside the Reich (Kloss's term) in 1910, a number of Germans were listed as members of other groups, especially the German-Swiss, German-Hungarians, and German-Russians. In an attempt to show the true home of these ethnic Germans, the organizational maps combine church membership information with census data. Series D maps, for example, show the population totals of foreign stock from Russia in 1910 and church congregations as of about 1930 for the central and northern Great Plains states. Ten different combinations of church groups are shown which illustrate that intersettling of religious groups was widespread. Other maps in the series show the distribution of Roman Catholic German congregations in the United States as of 1892, complete with the churches, the number of German-speaking families, and whether or not a German priest served the church.

When two distinct culture groups occupy the same political unit and vie for political control and dominance, the result is conflict and internal discord that may threaten the structure of the unit. D. G. Cartwright, in an exercise in applied ethnic geography, observed that the maintenance of two major linguistic and cultural groups in Canada has been less than successful.⁴² In 1969 the Canadian Bilingual Districts Advisory Board, acting to put into operation the Official Languages Act of Canada, developed the concept of language zones. The act required provincial officials to establish potential bilingual districts and to delimit their boundaries anywhere a linguistic minority formed at least 10 percent of the total population. To test the applicability of the premises of the act and to develop a method whereby equitable bilingual districts could be established, Cartwright mapped the French mother-tongue population in New Brunswick, Nova Scotia, and Prince Edward Island by enumeration areas and census divisions for 1971. Using figures for the language spoken in the home and for the official language—that is, the language spoken at work, at school, or at church—obtained from Statistics Canada, Cartwright developed a language-intensity index that served as a measure of language retention and therefore showed whether the group in any enumeration district was truly bilingual or was virtually monolingual. Although he recognized that his technique was not highly sophisticated, he did find that it served to communicate the basic patterns of bilingualism to administrators.

A number of medium-scale ethnic maps for groups as varied as the Melungeons of Appalachia to the Dutch Reformed of Michigan have been made by geographers and others, using a variety of data sources. In most cases the method and purpose of their making closely parallels those already discussed.⁴³

⁴² D. G. Cartwright: The Designation of Bilingual Districts in Canada Through Linguistic and Spatial Analysis, *Tijdschr. voor Econ. en Soc. Geogr.*, Vol. 67, 1977, pp. 16–29, reference on p. 16.

⁴³ A brief list of ethnic maps, which represents a variety of groups and a wide range of data sources, is appended here. Johnson, for example, used Iowa state census returns for 1856 to map German-born by township (Hildegard Binder Johnson: The Location of German Immigrants in the Middle West, *Annals Assn. of Amer. Geogr.*, Vol. 41, 1951, pp. 1–41.) She included smaller-scale maps of German-born in the twelve midwestern states for 1870 and 1900 showing Germans as a percentage of the total population and several large-scale maps of German settlements in midwestern states. Hewes was unable to obtain reliable data from the federal census to map the Indian population in eastern Oklahoma and instead made a map based on Indian Service surveys, school-age enumerations, and tuition-claim reports made to the federal government (Leslie Hewes: The Oklahoma Ozarks as the Land of the Cherokees, *Geogr. Rev.*, Vol. 32, 1942, pp. 269–281). Price had similar difficulties with the federal census (Edward T. Price: The Melungeons: A Mixed-Blood Strain of the Southern Appalachians, *ibid.*, Vol. 41, 1951, pp. 256–271). Bjorklund's map of Dutch cultural features in southwestern Michigan shows the distribution of churches, landownership, and boundary lines indicating the areas where Sunday business and taverns are prohibited (Elaine M. Bjorklund: Ideology and Culture Exemplified in Southwestern Michigan, *Annals Assn. of Amer. Geogr.*, Vol. 54, 1964, pp. 227–241). D. W. Meinig used Spanish-surname data from the federal census to map the Spanish-American population in "Southwest: Three Peoples in Geographical Change, 1600–1970" (Oxford Univ. Press, New York, 1971) and in "Imperial Texas: An Interpretive Essay in Cultural Geography" (Univ. of Texas Press, Austin, 1969). A map of six major ethnic groups in Hawaii based on United States census data is in R. Warwick Armstrong, edit.: *Atlas of Hawaii* (Univ. of Hawaii Press, Honolulu, 1973), p.

LARGE-SCALE RURAL AND URBAN MAPS

Although general questions about the interrelationship between ethnic populations and the geographical processes of migration and settlement can be adequately treated with detailed medium-scale maps using data recorded by minor civil division, the more exacting questions that relate to the processes of culture transfer, acculturation, assimilation, and the maintenance of ethnic identity and territory can be best approached at the largest possible scale, the residential cluster of community or, ultimately, the family.

In his attempt to measure the transferal of the traditional Scandinavian structure of ethnic regional identity (*bygd* identification) to Minnesota settlements in the nineteenth century, John Rice found that the fealties of ethnic identity changed as the level and perspective of analysis changed. At the primary level—that is, from the point of view of the individual—the peasant in nineteenth century Europe identified first and foremost with his village. Beyond that he probably identified with his parish, and on a more general level, with his province. At a secondary level, from the point of view of the nonethnic or outsider, this same person, after migration to the New World, would be ascribed an identity based on language (but not necessarily dialect) and country of origin as, for example, a Swede. To ascertain how ethnic identity at the primary level might have transferred to the New World and how it might have influenced migration decisions or settlement choices, Rice mapped individual landowners by national origin for each township in Kandiyohi County, Minnesota, for the years 1880 and 1905 at a scale of about 1:380,000. The Swedish landowners were then mapped according to Swedish provincial origin. The provincial map shows a high degree of clustering, implying that settlement choices were strongly influenced by the location of peer or *bygd* groups. When a third map, church membership, was superimposed on the provincial origin map, it became evident that many of the provincial settlements had evolved into church-centered communities in which the churches acted as instruments of identity reinforcement.⁴⁵ Rice believed that this type of community cohesion created a higher degree of persistence among the Swedes who tended to stay in their communities once established than among other groups such as the Irish or Old Stock Americans. Because the Swedes remained stationary they improved their economic status relative to these other groups, who had lower levels of community cohesion and a greater tendency to move on to new settlements after a few years.⁴⁶

Robert C. Ostergren also examined this premise—that cultural homogeneity is positively related to community stability—by mapping rural landowners in Chisago County, Minnesota. By using the 1885 state census manuscripts and an 1888 plat book, he was able to map individual landowners by ethnic groups, as Rice had, and found that a number of the most concentrated settlements were made up of immigrants from the same small communities in the homeland. A number of these settlements had maintained a high level of cultural homogeneity in the preservation of customs, dialects, and even social patterns. Although the number of observations was small, the study did reveal a significant relationship between stability and cultural homogeneity.⁴⁶

105. Two maps, one a map of the generalized migration routes of a variety of European immigrant groups into North Carolina and the other a small-scale map of "The Pioneer People of North Carolina" showing ten different immigrant groups, appear in James W. Clay, Douglas M. Orr, Jr., and Alfred W. Stuart, eds.: *North Carolina Atlas: Portrait of a Changing Southern State* (Univ. of North Carolina Press, Chapel Hill, 1975), pp. 16-17. For a generalized map of ethnic settlements in Missouri see Russel L. Gerlach: *Population Origins in Rural Missouri*, *Missouri Hist. Rev.*, Vol. 71, 1976, p. 2; and for maps of Germans in Nebraska based on 1870 census data see Frederick C. Luebke: *Immigrants and Politics: The Germans of Nebraska, 1880-1900* (Univ. of Nebraska Press, Lincoln, 1969), pp. 20, 22, and 74-116.

⁴⁵ John G. Rice: *Patterns of Ethnicity in a Minnesota County, 1880-1905*, Dept. of Geography, *Geogr. Rept.* 4, Univ. of Umeå, 1973, pp. 41-48.

⁴⁶ John G. Rice: *The Role of Culture and Community in Frontier Prairie Farming*, *Journ. Hist. Geogr.*, Vol. 3, 1977, pp. 155-175, reference on p. 172.

⁴⁷ Robert C. Ostergren: *Cultural Homogeneity and Population Stability among Swedish Immigrants in Chisago County*, *Minnesota History*, Vol. 43, 1973, pp. 255-269, reference on p. 259.

The maps discussed to this point have portrayed primarily rural ethnic groups. Those who have attempted to make ethnic maps in urban and suburban areas have experienced some of the same difficulties with inconsistent census definitions of ethnicity or nationality as have the makers of rural maps. There are additional problems in mapping urban groups, such as a lack of uniform-sized data units or data unit boundaries that change over time (census tracts, for example), which do not weigh as heavily on the maker of rural ethnic maps. In part for this reason, and also because the larger scale of the urban ethnic map demands a greater degree of accuracy in the location of boundaries between groups, geographers and others have developed a number of valuable techniques for mapping urban groups. I have chosen to comment here only on those maps that are not based on standard census data. This type of map is quite common, and there are probably dozens of cities for which ethnic maps have been published using standard census tract or block data. Unfortunately, such maps often have limited value because they show only those groups which have been defined in the census or because the census data units are not of sufficiently large scale to show the abrupt changes in ethnic residential areas that commonly occur in many large cities.⁴⁷

A method for mapping ethnic groups in urban areas using data other than from a census was devised by Harold F. Creveling.⁴⁸ A number of transplanted groups from Europe, as he saw it, still maintained a level of cultural distinctiveness in 1955, especially in the industrial and commercial centers of the Northeast, sufficient to warrant study by urban geographers. Creveling found that federal census materials had two major shortcomings for this type of mapping. First, data were tabulated only for foreign-born or for the children of foreign-born, so the presence of groups that had maintained their identities through several generations could not be ascertained. Second, the census did not distinguish between religious groups from the same country, such as Jews and Catholics from Poland.⁴⁹ To obtain primary data on the widest possible range of groups Creveling used personal interviews that he controlled for location by superimposing a quarter-mile grid on a city street map. Interviews were then conducted at each grid intersection and at the center of each grid cell. At each point two or more persons were asked if the neighborhood was occupied by a particular ethnic group. Using this method, he mapped thirteen cultural groups in Worcester, Massachusetts, which were predominant in at least one cell. The completed map is complex because few groups occupy neighborhoods that extend for more than a few blocks.

Bryan Thompson recently completed a map of the ethnic groups of Detroit using Creveling's interview and grid-control method.⁵⁰ To obtain information on a broad range of ethnic groups Thompson, for the purposes of mapping, defined them as "all groups defined by race, religion, language, or national or regional origin."⁵¹ Therefore, such diverse groups as Jews, blacks, Ukrainians, Armenians, and southern whites were included in the study. Thompson used a one-mile interview control grid. Four unstructured interviews were conducted in each

⁴⁷ See, for example, Clifford R. Shaw and Henry D. McKay: *Juvenile Delinquency and Urban Areas* (rev. edit., Univ. of Chicago Press, Chicago, 1969), p. 41 (Chicago map); John F. Kain: *Race, Ethnicity, and Residential Location, Discussion Paper D 75-3*, Dept. of City and Regional Planning, Harvard Univ., Cambridge, Mass., 1975 (Cleveland map); Ying-Ching Kiang: *The Distribution of the Ethnic Groups in Chicago, 1960*, *Amer. Journ. Sociol.*, Vol. 74, 1968, pp. 292-295. Other citations may be found in Bryan Thompson: *Ethnic Groups in Urban Areas: Community Formation and Growth, Exchange Bibliography No. 202*, Council of Planning Librarians, Monticello, Ill., 1971.

⁴⁸ Harold F. Creveling: *Mapping Cultural Groups in an American Industrial City, Econ. Geogr.*, Vol. 31, 1955, pp. 364-371.

⁴⁹ Creveling, *op. cit.* [see footnote 48 above] p. 1.

⁵⁰ Bryan Thompson: *Detroit Area Ethnic Groups: 1971* (Wayne State Univ. and Detroit Public Schools, TTT Project, Detroit, 1971). The method of mapping and interpretation of the finished map are discussed at length in Bryan Thompson and Carol Agocs: *Mapping the Distribution of Ethnic Groups in Metropolitan Detroit: A Preliminary Report* (unpublished manuscript, 1972, quoted here by permission); and *idem*, *Studying the Local Community: A Community Survey and Ethnic Mapping Procedure* (Ethnic Heritage Studies Center, Detroit, 1975).

⁵¹ Thompson and Agocs, *Distribution of Ethnic Groups* [see footnote 50 above] p. 1.

grid cell. Informants, who might have been shopkeepers, residents, or pedestrians, were asked to describe the ethnic composition of the neighborhood, and responses were recorded on a structured questionnaire form. The scale of the finished map is approximately 1 : 1,000,000. Of some fifty groups recorded by interviewers, eleven were mapped using four basic colors. Nine different group combinations in which no single group (such as Polish and Italian) was predominant were included.⁵³

A problem in compiling maps from interview data, which has been pointed out by Bryan Thompson and Carol Agocs, is that the map represents perceptions or subjective judgments of respondents that might have been highly variable in quality or distorted by personal prejudice.⁵⁴ Despite this and other limitations, the outstanding virtue of the large-scale urban ethnic map is that it suggests a number of questions or hypotheses about urban residential structure. On the Detroit map, for example, several ethnic groups, such as southern whites, Arabs, and Irish, appear in clusters, whereas others, such as Jews, Poles, and blacks, tend to expand along corridors. This distribution suggests that the process of intraurban migration may be related to the character of the ethnic group to a greater extent than previously thought.

At a very large scale, block maps of ethnic groups have been made by Paul Hatt and Kathleen Conzen. Using data from a 1939 real property survey conducted by the Works Progress Administration, Hatt mapped gentile whites, Ashkenazic Jewish whites, Sephardic Jewish whites, Negroes, Japanese, Chinese, and Filipinos in the residential area of central Seattle.⁵⁵ He chose to distinguish between the Sephardim and the Ashkenazim because they had different cultural patterns, because they occupied different neighborhoods, and because, through fieldwork in the city, he found that the individuals themselves were conscious of the differences between the two groups. Only dominant groups, defined as occupying 50 percent or more of the dwelling units in any single block, were mapped. Hatt observed two significant patterns on the map. The entire area, when considered as a whole, was predominantly gentile white even though it included most of the sizable ethnic minority islands in the city. Furthermore, blocks dominated by minorities were frequently not adjacent. Hatt thought that the scatter of groups could be a function of the size and alignment of blocks and streets and that the block was not a suitable aggregation unit. Moreover, he believed that some ethnics might prefer locations across a street from one another rather than across an alley as is assumed when blocks are used as the data unit. To correct for this possible bias he remapped the area by household without reference to the size or nature of the block population. The household map shows the Japanese and Ashkenazim to be predominant over a wider area and to be almost mutually exclusive in location. Because the other groups did not predominate over areas larger than blocks and there was little block-to-block association between any two ethnic types, Hatt concluded that invasion and succession were likely to be block-to-block processes that skipped intervening groups or blocks.⁵⁶

Mapping ethnic groups at the household level using manuscript census materials requires considerably more care than Hatt apparently had to exercise with the 1939 survey. Kathleen Conzen examined the development of distinctive ethnic residential areas in Milwaukee to try to establish whether segregation among immigrant groups in the nineteenth century resulted from

⁵³ *Ibid.*, p. 9. A study of ethnic residential persistence in northeast Minneapolis has been done using the Creveling and Thompson grid-controlled interview method, with modifications to allow greater reliability of response for a relatively small area (Richard Wolniewicz: *Ethnic Persistence in Northeast Minneapolis: Maps and Commentary, Research Study No. 1*, Minneapolis Project on Ethnic America, Minneapolis, 1973, pp. 1-10).

⁵⁴ This is not necessarily a disadvantage in mapping ethnic groups if the problem is understood at the outset. Mapping an ethnic group's perception of neighborhood boundaries or the territory of other groups could be a valuable addition to the ethnic literature. For a map of the Addams neighborhood of Chicago based on definitions given by local residents see Gerald D. Suttles: *The Social Order of the Slum: Ethnicity and Territory in the Inner City* (Univ. of Chicago Press, Chicago, 1968), p. 17.

⁵⁵ Paul Hatt: *Spatial Patterns in a Polyethnic Area, Amer. Sociol. Rev.*, Vol. 10, 1945, pp. 352-356, map on p. 353.

⁵⁶ *Ibid.*, p. 356.

socioeconomic variations between groups or whether concentration was characteristic of all groups.⁶⁶ In attempting to map Milwaukee's ethnic groups from the 1860 federal census manuscripts she found that although nationality information was available for individual households, it was very difficult to assign spatial coordinates to specific households because many addresses were imprecise, a condition abetted by a lack of names and numbering on many city streets, and because too few household base maps were available which coincided with the date of the census. To solve the problem Conzen aggregated the household data into four-block-square areas with boundary lines drawn along alleys and mid-blocks. The grid was then laid over a city plat map and adjusted to fit actual street and lot lines.⁶⁷ The resulting map shows those groups which were predominant—that is, which constituted 60 percent or more of the population in each grid—and provides a reliable way to measure clustering.

CONCLUSION

Clearly, making an ethnic map involves a number of perplexing problems, but if the difficulties are recognized and successfully met, the finished map may have a number of uses. Perhaps the most difficult problem encountered in mapping ethnic groups is arriving at an accurate definition of those groups that are central to the study and finding a reliable data source that will allow one to identify the group or groups at the largest possible scale. Definition of groups is a serious problem in Canada and the United States because ethnicity has a number of forms and is based on a variety of cultural and historical components. Consequently, some groups are classified by national origin (first- or second-generation European immigrants), language (French-speaking Canadians), religion (Jews and possibly Mormons), race (American Indians and blacks), minority status (Mexicans and Puerto Ricans), the so-called new ethnics (fourth-generation European-Americans such as the Polish), or even region (Appalachian whites). The type of group one wishes to map will suggest the data source that will be most helpful. For example, recent United States censuses enumerate foreign-born and children of foreign-born and also list a large number of groups by mother tongue, but this information provides no reliable way to identify those groups that have been residents for three or more generations. Nor can the census adequately identify religious groups such as the Jews, unless one is willing to accept a surrogate group such as the Russians—many of whom are Jewish. Moreover, groups who were minorities in their home countries, Friulian and Calabrian Italians, for example, or whose countries no longer exist, such as the Estonians, are not enumerated in the census.⁶⁸

Small-scale ethnic maps are usually based on standardized data sources such as a census. Although such maps are usually interesting and show gross settlement patterns or suggest general questions about migration routes or environmental affinity, they have limited value in studies of the spatial aspects of the processes of assimilation, or invasion and succession. The more innovative techniques in map compilation have been developed by those making medium- and large-scale maps. Medium-scale maps that are based on several different types of information, including surname counts from plat books or field interviews, are the product of long hours of laborious compilation, and the resulting maps are generally accurate and quite useful in studies that address problems such as the relationship between ethnic identity and political behavior or economic productivity. The large-scale ethnic map can be the most difficult to make because of the need for detailed data and the accuracy required for plotting group boundaries, which can become critical, in some cases, in as short a distance as the width of a street. Consequently, the most useful large-scale maps involve a considerable amount of

⁶⁶ Kathleen Neils Conzen: *Immigrant Milwaukee: 1836-1860: Accommodation and Community in a Frontier City* (Harvard Univ. Press, Cambridge, Mass., 1976), p. 126.

⁶⁷ Kathleen Neils Conzen: *Mapping Manuscript Census Data for Nineteenth Century Cities*, *Hist. Geogr. Newsletter*, Vol. 4, 1974, pp. 1-7.

⁶⁸ Bryan Thompson and Carol Agocs: *Ethnic Studies: Teaching and Research Needs*, *Journ. of Geogr.*, Vol. 72, 1973, pp. 13-23, reference on p. 16.

fieldwork and require a variety of sources that may include city directories, fire insurance maps, and special census counts.

In Europe, ethnic cartography has been applied to a variety of political problems.⁸⁹ Some maps have been used to delimit spheres of national influence as reflected in the presence of ethnic groups outside their national area. Other maps have been used to align political boundaries, and in some cases cartographers have manipulated data sources and map patterns for political gain and to influence international relationships. Ethnic maps of Canada and the United States have primarily been tools for the study of migration, segregation, assimilation, invasion and succession, and problems of community structure and thus have heuristic and analytical value for the researcher. However, the student of ethnic maps must be wary and should give careful consideration to the context in which the map was made, to the theoretical concepts which give purpose to the map, to the definitions used to categorize groups, and to the source and reliability of the information used in compilation before the usefulness of the map to his or her purposes can be determined.

⁸⁹ For a review of ethnic maps in Europe see H. R. Wilkinson: *Ethnographic Maps*, *Proc. Eighth General Assembly and Seventeenth Internatl. Congr., Internatl. Geogr. Union*, 1952, pp. 547-555; and Henry R. Wilkinson: *Maps and Politics: A Review of the Ethnologic Cartography of Macedonia* (Univ. of Liverpool Press, Liverpool, 1951).

APPLIED GEOGRAPHY

MINING, MARKETS, AND LAND USE

TIMOTHY D. TREGARTHEN, ROBERT P. LARKIN, and GARY L. PETERS

AN INCREASING demand for energy resources in the United States, brought about by a growing and more affluent population, will lead to a concomitant increase in mining activities in the final quarter of the twentieth century. Coal occurs in abundance in the United States and is likely to be of major importance in the future energy policy of this country. Of concern to many planners are the land use implications of increased production of coal, especially the increasing percentage and the changing spatial pattern of production coming from strip mines (Fig. 1).

Although the Appalachian region presently produces the bulk of the coal in the United States, primarily from underground mines, indications are that future production from western fields will take a larger share of the coal market at the expense of eastern production.¹ Some of the largest coal deposits in the country are located just east of the Rocky Mountains, notably in the states of Montana, Wyoming, North Dakota, and Colorado (Fig. 2). Located at depths of 10 to 150 feet, the bulk of these coal seams are well suited for strip mining and would have a recovery rate of more than 70 percent. Although the BTU content is somewhat lower than that of eastern coal, western coal is low in sulfur content and, therefore, desirable for utilization in the generation of electricity. The land use implications and spatial allocation decisions involved with the increase of mining activities in the West is of major concern to the future of energy production in the United States.

In this paper we focus on decisions that involve competitive land uses, in particular those that relate to the extraction of exhaustible natural resources. We examine the marketplace as one device used in making such decisions and consider the dangers involved in leaving these matters solely to it. Guidelines for spatial allocation decisions are outlined in an effort to incorporate nonmarket factors relevant to land use decisions concerning mining. We also consider the impact of mining on regional income and employment.

THE MARKET

Watkins, Colorado, is not in the forefront of discussions about mining or the energy crisis. It is a rural community in a nation that is urban; it is on the High Plains in a state known for its mountains. But it has coal. Inconveniently, Watkins also has considerable amounts of grazing land devoted to the production of beef, and it offers pleasant living to people who seek escape from the urban ills—but not the jobs—of nearby Denver. Coal mining, cattle grazing, and urbanization are not compatible activities; they may even make disagreeable neighbors. As a result Watkins, like other communities rich in resources, is faced with important land use choices that will determine the fundamental quality of the area and the nature of its growth.²

Consider, then, a hypothetical rancher in Watkins, on whose ranch deposits of coal have been discovered. The rancher has worked his thousand acres for the past fifty years. He owns

¹ H. Reid Wagstaff: *A Geography of Energy* (W. C. Brown Company, Dubuque, 1974), p. 15.

² For a discussion of the Watkins case, see Elizabeth Ingraham: *Lead Time for Assessing Land Use: A Case Study*, *Science*, Vol. 194, 1976, pp. 17-22; and Timothy D. Tregarthen: *Food, Fuel, and Shelter: A Watershed Analysis of Land Use, Trade-off in a Semi-Arid Region* (Westview Press, Boulder, Colo. 1978).

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the land and the mineral rights to it. A Denver developer has indicated an interest in purchasing the land for a subdivision. Our rancher thus faces three choices. He can continue ranching, sell to a mining company, or sell to the developer.

His first problem, then, is to estimate the benefits of each alternative. To simplify matters, we will assume that the rancher is that most ubiquitous of creatures (in economic theory at least), the profit maximizer, his sole goal being to realize the greatest profit possible from his land. Our rancher is earning, and expects to continue to earn, a net annual return of \$30 per acre, an annual income of \$30,000. A coal company has offered a million dollars for all rights to the land; the developer will pay \$750,000.

It is important to consider carefully the meaning of each of these figures. The net return of \$30,000 is converted to a total present value by dividing by the rate of interest, which we will take to be 5 percent. Ignoring possible changes in the sale value of the land, this means the land has a value for ranching of \$600,000—the amount that, if put in the bank at 5 percent, would yield an annual income of \$30,000. The figure of \$600,000 can be interpreted as the net present value that the market places on present and expected future production of the ranch. This information is provided to the rancher by the market in its determination of prices for beef, labor, feed, grains, and so forth.

The offers of the developer and the coal company may be similarly interpreted. They represent the estimates of the present value of the future streams of benefits associated by the market with each activity. The coal company has presumably estimated future price and cost trends of coal in the market. Its offer should reflect its estimate of the value of this stream, after deducting the cost of labor, of materials, and of a return on the proposed investment by the company. We are not endowing miner, developer, and rancher with uncanny precision or perfect foresight; we are merely asserting that it will be in the best interest of each of them to base their offers on their own estimates of the values the market will place on the alternative they are accustomed to pursuing.

Given this, the rancher's problem is easily resolved. He will sell to the miner. By staying in ranching, he is losing \$20,000 a year (the million dollars would earn annual interest of \$50,000; the rancher is now getting a net return of only \$30,000). By this process the market allocates goods and services. Individual consumers and firms, operating in their own self-interest, make decisions that seem reasonable to them at the time.

But economic systems should serve people, not markets. Does the land use decision made by our Watkins rancher best serve the interests of society? The answer depends on whether the information provided by the market about the relative values of the alternatives is correct.

Consider the information provided the rancher concerning the alternative of continuing to graze cattle on his ranch. The net figure of \$30,000 a year is a valid guide to valuation of his efforts by society only if it reflects all of the costs and benefits of that alternative.

NONMARKET FACTOR: THE VALUE OF OPEN SPACE

Ranching provides two services to society—beef production and the preservation of open space. The price system provides signals concerning the value of beef but not of the open land. The somewhat improved sense of well-being owing to having unsubdivided and unstripped plains nearby is a benefit that any individual in the surrounding community can enjoy whether he pays for it or not. Unlike the case of bread, apples, or coal, it is not possible to exclude nonpayers from the enjoyment of being surrounded by open space with its attendant benefits of flood control, air pollution reduction, aquifer recharge, and scenic beauty. The characteristic of nonexclusion qualifies the open space component of the rancher's output as a public good, which the market is unlikely to include in its calculation of costs and benefits. Though the benefits of open space derived by society may be great, those derived by any one individual are likely to be small. An individual's contribution for open space is also not likely to have an appreciable effect on the amount available for that person to enjoy; he or she will get the same amount whether it is bought or not. An individual is therefore not required to express his or her preferences in the market for open space in the same manner that he or she expresses

preferences in the market for bread. The existence of this open space benefit implies that the price system will generate signals to the rancher that imply a zero value for open space, despite its real economic value to individuals.

Another kind of difficulty emerges in considering the offer of the mining company. The market provides a reasonably good estimate of the benefits of coal but may not generate

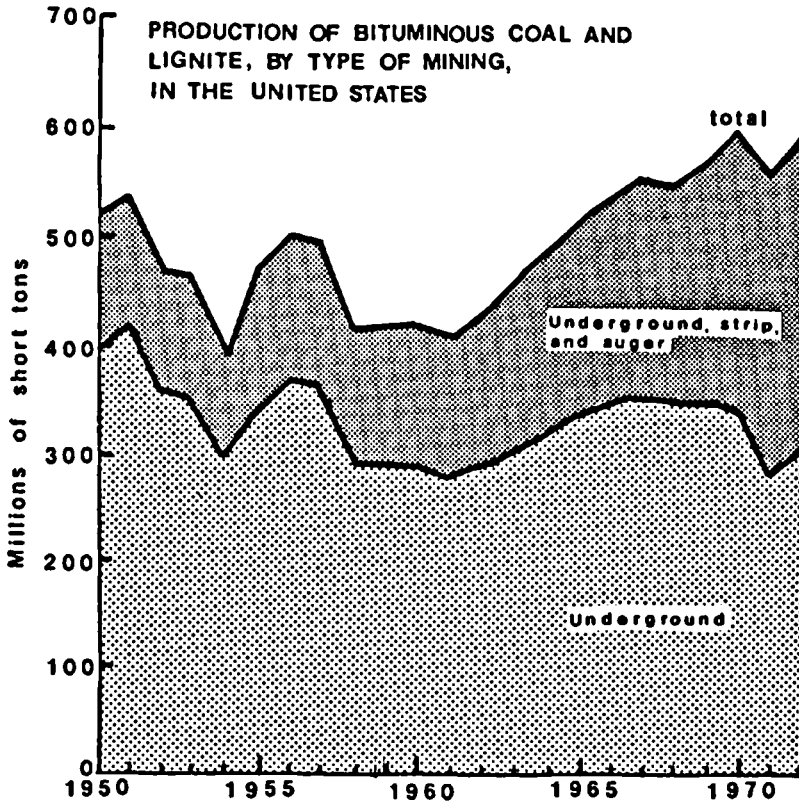


FIG. 1—Coal production according to type of mining. Adapted from *Minerals Yearbook 1973*, Vol. I: Metals, Minerals, and Fuels, (U.S. Dept. of Interior, Bureau of Mines, Washington, D.C., 1975), p. 325.

sufficient information about the cost of extraction. If strip mining leaves an eyesore that cannot be reclaimed quickly (or even slowly), if it exposes downwind neighbors to excessive dust, or if it subjects downstream neighbors to greater pollution, then there are costs that the market is unlikely to force the company to consider in its offer. Similar problems may be encountered with the developer's offer—the costs associated with urban sprawl may not be fully borne by the people doing the sprawling. These costs, referred to in economics as external costs, are real—but they are not incorporated in the process at the market level decision making. Their presence implies that the market will overstate the net benefits of mining and of subdivision development.

The marketplace may thus provide our rancher with incorrect estimates of the net benefits of the three alternatives we have considered. It may understate the benefits of continued ranching and it may overstate the benefits of mining and of development. Given the existence of cost and benefit factors whose very nature suggests that they will be ignored, it is necessary to consider ways of estimating and incorporating such nonmarket factors into the decision-making process for spatial allocation.

STRIPPABLE COAL RESERVES OF THE CONTERMINOUS UNITED STATES

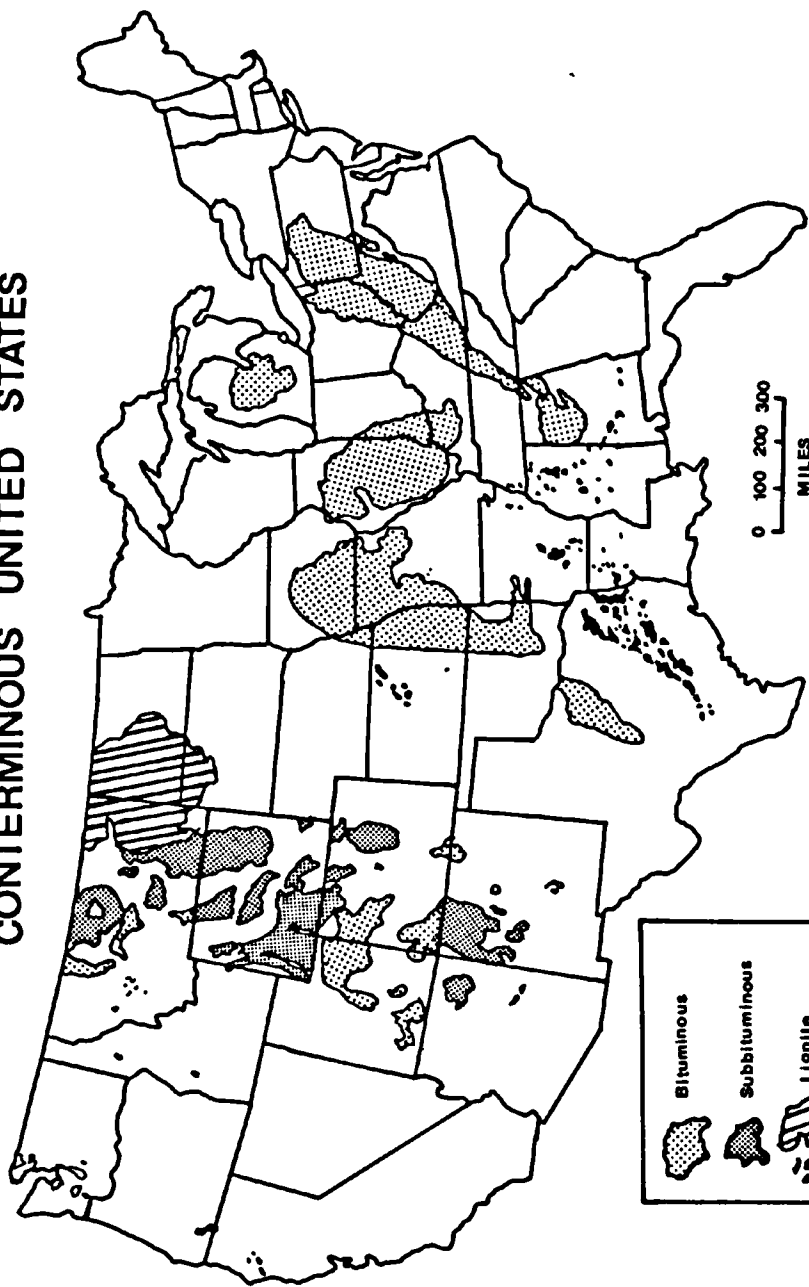


FIG. 2.—Distribution of coal reserves in the United States. Adapted from "Stripable Reserves of Bituminous Coal and Lignite in the United States," U.S. Dept. of Interior, Bureau of Mines, Washington, D.C., 1971, p. 10.

BENEFIT-COST ANALYSIS

The technique most often used in estimating benefits and costs is called, appropriately enough, benefit-cost (or cost-benefit) analysis.³ It was first used by the French economist Dupuit in the middle of the nineteenth century in an effort to assess benefits of public utilities, and has since been used widely as a tool in spatial allocation decisions.

Benefit-cost analysis is a method devised to estimate the benefits and the costs of a proposed activity over a period of time, to convert the stream of benefits and costs to a present value, and to compare the present values of alternative projects. The alternative with the highest present value (a concept we will explain more fully below) should be chosen. In the case of the mining proposal, for example, this process will be a better indicator of the social value of that alternative than the market-determined estimate.

The first, and in many ways most difficult, problem is the technique by which future costs and benefits are converted to values that can be used for decisions today. Suppose, for example, we have a project for which we have estimated benefits of \$1,000 a year for the next ten years and for which all costs, estimated at \$8,000, will occur immediately. Benefits may not exceed costs for this project because costs must be borne today while benefits accrue in the future. People prefer dollars paid today to equal sums payable in the future; for this reason interest rates exist. Suppose, for example, that we have a world with no inflation, and someone offers risk-free bonds. Would it be necessary to offer an interest payment on these bonds? The answer is yes—the rate offered is a payment to those who are postponing consumption by buying the bonds. The payment of interest rates induces some agents—lenders—to forgo current consumption so that other agents—borrowers—can engage in consumption earlier.

If an amount, P_0 , is deposited in a savings account and the interest rate is r , then the amount due the bondholder at the end of one year is P_1 , where $P_1 = P_0 + rP_0$ or $P_0(1 + r)$. Alternatively, the present value (P_0) of (P_1), assuming the same interest rate, may be expressed $P_0 = P_1/(1 + r)$. The present value, P_0 , of a sum, P_t , to be paid in t years from the present at interest rate r is given by $P_0 = P_t/(1 + r)^t$. This formula can be used to discount any future cost or benefit to its present value. The present value is the amount, P_0 , that we would have to put in the bank today, earning interest r , to have P_t dollars in t years, assuming we allow interest payments to accumulate in the account. Using this formula, the \$1,000-a-year benefit stream over ten years described above would have a present value of \$7,713 with an interest rate of 5 percent. We would do better to put our \$8,000 in the bank at 5 percent than to undertake this project. But if we discount this stream at a 4 percent interest rate, the present value becomes \$8,111. On the other hand, if we discount at the figure recommended by the U.S. Bureau of Mines, 12 percent, the present value falls to \$5,658.⁴ Our choice of a discount rate is clearly an important one.

One could object that none of this really matters as long as we use the same discount rate to compare present values of alternatives, but this may not be the case. Consider the alternatives of strip mining the coal or keeping the land in agriculture. Suppose further that if mined, the coal is taken out in a few years, but that reclamation is a lengthy process. The benefits of mining are realized within a brief period, but at least some of the costs extend well into the future. Selecting a high discount rate tends to increase the present value of net benefits; selecting a low discount rate reduces it. For ranching, however, the open space component of the benefit stream extends well into the future. Selection of a high discount rate reduces this present value. Given the magnitude of the differences created by juggling interest rates, the choice of the proper rate becomes crucial. It has been estimated, for example, that the use of a 6 percent rather than the 2.625 percent rate used would have disqualified almost two-thirds of federal water projects appropriated in 1962.⁵

³ E. J. Mishan: *Economics for Social Decisions* (Praeger, New York, 1971).

⁴ "Land Utilization and Reclamation in the Mining Industry, 1930-71" (U.S. Bureau of Mines, Washington, D.C., 1974).

⁵ Irving Fox and Orris Herfindahl: *Attainment of Efficiency in Satisfying Demand for Water Resources*, *Amer. Econ. Rev.*, May, 1964.

Unfortunately, few people agree as to what constitutes the correct discount rate. Values used in assessing federal projects range from 2 percent to 15 percent. The 12 percent rate noted above was selected because it approximates the rate of return on capital in mining. Looking at interest rates actually paid or received by consumers offers little help; one can get 5 percent on a savings account and pay 18 percent on a credit-card balance. Furthermore, the effect of inflation is a problem in looking at market rates of interest of any kind. If a loan is made at 8 percent interest, and prices rise by 5 percent before the loan is paid back (assuming it is to be paid back in one lump sum), then the real rate of interest is only 3 percent. The remaining 5 percent merely reflects the fact that the dollars used to pay back the loan have less purchasing power than the dollars that made the loan in the first place. After correcting for inflation, the interest rate on long term bonds has been fairly stable at 2 to 3 percent.

The debate among economists over criteria for the selection of a discount rate has been long and inconclusive.⁶ Discussions focus on how to find a rate that will reflect that paid by firms for new capital or whether a "social" rate of discount that is less than that paid by firms exists. These considerations, however, ignore the fact that many environmental effects touch individuals, not firms. Discount rates for such problems should reflect the rate at which consumers reveal a willingness to postpone present for future consumption. A rate on the order of 2 to 3 percent for real future aesthetic costs of surface mining, for example, should be reasonable, given the availability of such a real rate for consumers in bond markets. This rate emerges from an application of traditional considerations to the correct set of agents—consumers—and does not rely on uncertain claims that a social rate of discount exists apart from that observed in the marketplace. The application of a lower rate in discounting environmental costs will also place a greater weight on such costs in the analysis of proposed strip-mining projects and reclamation decisions.

To see the importance of the approach suggested here, consider a study which concluded that reclamation of strip-mined areas in eastern Kentucky was not justified on the basis of benefit-cost analysis.⁷ Aesthetic costs of surface mining were discounted at the 12 percent rate noted above, on grounds that this reflected capital costs facing mining firms. A lower rate reflecting alternatives available to consumers would have made considerably more economic sense and would have resulted in a much higher estimate of the aesthetic costs.

Having selected an interest rate, the next step is to project the benefit stream. In the case of our coal-mining proposal, the benefit is the coal. The easiest measure of this benefit is the market price, which must be projected forward. The recommendation above, concerning projections in constant dollars, simply means that estimates of future coal prices should separate changes reflecting a general inflation (or deflation—it does happen) in prices from changes in coal prices relative to other prices. It is the latter we want to show. This projection will be of particular importance for resources for which known reserves are rapidly dwindling. Such resources will become relatively expensive as they become available in lesser quantity at greater extraction costs and as owners of these resources attempt to conserve them over time. Such a projection may suggest delay of the mining activity until the benefit—or price—is greater.

A second benefit often claimed for mining as well as other projects is increased employment. New mining jobs, it is argued, bring new people, creating the need for more grocery clerks, teachers, and other nonrelated jobs. The nature of this "multiplier" effect on local economic activity will be discussed later. Although labor seems a more likely candidate for the cost than the benefit category, it is sometimes asserted that projects utilize unemployed workers, whose opportunity cost is zero. Recording the cost of labor as zero would have the same effect as

⁶ For a brief review of the issues involved, see John Krutilla and Anthony Fisher: *The Economics of Natural Environments* (Johns Hopkins Univ. Press, Baltimore, 1975) pp. 60-65. A good review of the literature is given in J. H. Seagraves: *More on the Social Rate of Discount*, *Quart. Journ. Econ.*, Vol. 84, 1970, pp. 430-450.

⁷ Herbert A. Howard: *A Measurement of the External Diseconomies Associated with Bituminous Coal Surface Mining, Eastern Kentucky, 1962-67*, *Natural Resources Journ.*, January, 1971, pp. 76-101.

adding labor on the benefit side to offset the wage cost. This argument, however, is valid only if no other potential opportunities for local workers, including relocation, exist. Because such a case is unlikely, counting employment as a benefit or as a zero cost component of the analysis is a dubious practice.

More difficult problems are encountered in estimating the cost stream of nonmarket factors—those for which market prices do not conveniently exist. Some object in principle to any attempt to measure a quality as subjective as, for example, aesthetic costs. Can we put a price tag on a ravaged landscape? The answer is that we not only can, we must. Given some estimate of other benefits and costs, a decision always implies some valuation of aesthetic factors, whether they are included explicitly in the analysis or not. Selecting a value of zero (or infinity) on grounds that beauty lies in the eye of the beholder, rather than in a column of a ledger, makes little sense.

Aesthetic costs represent a form of negative externality. A method is needed of estimating the harm that will occur to each individual affected by the proposed strip mining in each year that such costs are expected to occur. Little has been done to develop such a method. Therefore it is understandable that in the study of surface mining and reclamation cited above, the author simply assigned aesthetic costs of one dollar per acre of mined land. This is a useful technique. By assigning an arbitrary value to an uncertain variable, it is possible to discover at what level a change in decision would be indicated.

Pollution costs pose similar problems of estimation. If dust is to be experienced, how much does that cost? Health costs of air pollution can be estimated, but only if we can determine the amount of pollution directly attributable to the project. Some costs, however, lend themselves to quantification more easily. If the mining increases costs of water purification downstream, reasonably good estimates of these costs can be obtained.*

A final factor to consider is the cost of reclamation. Most of the land affected by strip mining in recent years has been reclaimed. But the definition of reclamation here is simply that local, state, or federal laws were complied with in whatever effort was undertaken. Some natural areas may take more than a hundred years to return to an approximation of their former state, while reclamation for agricultural use, recreation, or new development takes considerably less time. The single general point which can be made on this score is that alternative reclamation approaches—including no reclamation at all—should be considered in each mining proposal. To impose a general rule applicable to all projects makes no sense.

REGIONAL INCOME AND EMPLOYMENT

We have already noted that the workers hired will create a need for still more workers. If our Watkins mining project survives the incorporation of nonmarket costs and benefits, the increase in employment it will generate must be determined so that public services and land use planning will reflect the need of an increased population.

The procedures for estimating such impacts are well known and widely practiced.* They involve estimating the share of local employment that can be attributed to demands on the system from outside the local area of interest. This export-related employment is typically termed "basic." The remaining jobs, termed "nonbasic," serve the needs of people holding basic jobs. Basic employment thus drives the system. Given the relationship between basic and nonbasic employment in an area, the number of nonbasic jobs created as a result of an increase in basic employment can be predicted. Because coal output is typically exported, new jobs in this activity will represent basic employment. If for every basic job in an area there are an estimated 1.2 nonbasic jobs, the increase in total employment, called a multiplier, that will occur with each new basic job is 2.2.

* Allen Kneese provides an excellent summary of recent attempts to grapple with the quantification of environmental costs and benefits in his *Economics and the Environment* (Penguin, New York, 1977).

* Andrew M. Isserman: *The Location Quotient Approach to Estimating Regional Economic Impacts*, *Journ. Amer. Inst. of Planners*, Vol. 43, 1977, pp. 33-41.

Multipliers can be estimated fairly easily for local regions. Because new mining operations typically occur in relatively small towns with economies that depend heavily on imports, multipliers for new mining are likely to be quite low. Consider the extreme case of a mining camp in which all goods and services are imported. There are no nonbasic jobs; each new basic job, therefore, creates no additional jobs, and the multiplier is one.

Multiplier effects of mining operations are not only small, they are transitory. If employment continues, the mineral resource will ultimately be exhausted and the operation closed. If operations are closed or slowed to take advantage of an expected rise in prices, employment will again be cut back. In either case, the multiplier works in the opposite direction. The closing of Anaconda's copper mines in Butte, Montana, in 1975 (partly to take advantage of expected price increases in the future) was bemoaned by the governor of that state as an act that would cost Butte between five hundred and a thousand jobs in mining and total induced and direct income losses of \$60 million a year.¹⁰ Although this suggests a rather liberal estimate of the multiplier, it also implies a note of caution for communities that may view mining as the salvation of their economies. A visit to some of the ghost towns of California and of Colorado may do the same.

IMPLICATIONS FOR SPATIAL ALLOCATION DECISIONS

We have focused here on certain conceptual issues involved in mining in an effort to develop a framework with wide applicability. Although our hypothetical example involved the surface mining of coal, the principles developed here apply more widely—even to underground mining, where environmental degradation may occur from the dumping of wastes, future subsidence, and possible air and water pollution effects.

Perhaps the "energy crisis" that began in late 1973 focused attention on what will be a continuing dilemma for a considerable time to come. According to the Leonardo Scholars, "natural resource policy decisions made within the constraints of existing social organization inevitably contain seeds of conflict."¹¹ The land use conflict between beef production, urban development, and coal mining has been examined in an effort to establish the basic parameters necessary to make enlightened decisions.

In any spatial allocation problem, the first step is to examine carefully the probable market solution to determine whether factors exist that are not likely to be incorporated in the assessment of costs and benefits by the market. If there are, then it may be desirable to attempt to quantify these factors and to include them in the decision-making process. Reaching conclusions on such problems is no easy task; the quantification of relevant variables serves to clarify assumptions, but it offers no panacea. However, questions raised must be answered; the problems created must be solved. Holding out for an error-free approach only invites the error of indecision.

¹⁰ Thomas L. Judge: Senate Hears Testimony on Anaconda's Closing of Butte Underground Mines, *Engineering and Mining Journ.*, Vol. 176, 1975, p. 24.

¹¹ "Resources and Decisions" (The Leonardo Scholars; Wadsworth Publishing Co., Belmont, Calif., 1975), p. 1.

THE AMERICAN GEOGRAPHICAL SOCIETY

February 3, 1978

To the Fellows of the Society:

The following report on the activities of the Society for the year 1977 is published by order of the Council.

RICHARD H. NOLTE
President

ANNUAL REPORT TO THE COUNCIL

Descriptions of 1977 are as varied as definitions of geography. Some people characterize the year as one of frustration, because the Society did not receive legal clearance for the transfer of the AGS Library and Map Collection to the University of Wisconsin-Milwaukee. Some label the year as financially frightening, for the threat of bankruptcy became increasingly real. Others, the optimistic majority, view 1977 as the year the Society turned problems into opportunities. Everyone agrees, however, that 1977 was eventful, that it was another pivotal year in the Society's long history. It is too early to assess the full impact of the events of 1977, but already it is clear that the Councilors, staff, Fellows, and friends of the Society succeeded in maintaining the Society's tradition of providing the best in geographical publications and in laying the foundation for a secure and vital future.

THE SOCIETY'S ACTIVITIES

In 1977, as in recent years, the Society concentrated its efforts on producing the *Geographical Review*, *Focus*, and *Current Geographical Publications*. The *Geographical Review*, mirror of the wide range of interests in geography, continued to receive abundant first-rate manuscripts. Traditional research interests, especially in historical, cultural, urban, and economic geography, were well represented in Volume 67, and the journal broke new ground in such articles as Charles S. Aiken's sensitive "Faulkner's Yoknapatawpha County: Geographical Fact into Fiction," Robert W. Kates and Cindi Katz's insightful "The Hydrologic Cycle and the Wisdom of the Child," and Preston E. James and Cotton Mather's retrospective "The Role of Periodic Field Conferences in the Development of Geographical Ideas in the United States."

Along with "Geographical Record" notes on geographical literature and happenings and "Geographical Reviews" of recent books and monographs, the "Applied Geography" section was a regular feature of the *Geographical Review*. Created in 1976 as an outlet for reports on applications of geographical principles, techniques, and methodologies in solving "real-world" problems, the new section proved even more popular than expected. Interest was so great, and manuscripts so numerous, that the section appeared in each issue in 1977.

The title page, table of contents, and index to Volume 67, 1977, appeared as part of the October issue of the *Geographical Review*. With this innovation, readers have easier and more rapid access to the contents of the journal.

During the year *Focus* published two reports on the Ivory Coast, of which Editor Alice Taylor was principal author, and reports on China's developments, on desertification and deforestation, and on Puerto Rico. On line for 1978 are reports on the Law of the Sea, the Horn of Africa, and Europe's ethnic minorities.

The staff of the Library and Map Collection directed most of its energies to publishing *Current Geographical Publications*, the monthly annotated bibliography of additions to the

Society's 1.5-million-card Research Catalog. The AGS Collection received 4,971 serials, 480 books, and 825 pamphlets and documents. The staff also provided basic library services throughout the year: they served more than 500 consultants (visitors) and filled almost 1,000 telephone, letter, xeroxing, and interlibrary loan requests. In addition, they processed approximately 45,000 topical and regional cards for inclusion in the "Research Catalogue of the American Geographical Society—Second Supplement," covering the period from 1972 through 1976, which will be published by G. K. Hall & Co. in 1978.

Cooperative efforts between the Society and Scripta Publishing Co. of Washington, D.C., continued in 1977. Theodore Shabad, Editor of *Soviet Geography: Review and Translation*, provided excellent reports on Soviet research in geography plus his popular "News Notes" and listings of recent Soviet publications. The year also witnessed the birth of *Polar Geography*, under the editorship of Dr. Shabad. The new quarterly contains reports on current Soviet, Japanese, and West European research in the physical and human geography of the Arctic and Antarctic regions as well as the land and water masses poleward of 60°.

The Society's research and cartographic efforts remained curtailed, but work did go on in several areas. William O. Field, glaciologist par excellence, and Madeleine Secunda, his assistant, continued to assemble and organize the vast Glacier Studies collection of photographs showing changes in glaciers, vegetation, and other terrain features. Eventually the photographs will portray a case history of each significant glacier, and some will appear in a pictorial volume which Dr. Field is preparing. The transfer of photographs and other glaciological data to the World Data Center A for Glaciology in Boulder, Colorado, also continued. At the request of the U.S. Geological Survey, Dr. Field submitted data on seventy-seven glaciers along the southern coast of Alaska covering the years 1968 to 1975 for publication by the Permanent Service on the Fluctuations of Glaciers, IUGG-FAGS/ICSU, in Zurich.

The Society's long involvement with the massive "Historical Atlas of South Asia" culminated in 1977 with completion of the final corrections. Publication of the atlas, by the University of Chicago Press, is scheduled for 1978. Also nearing completion is Harold C. Conklin's "Ethnographic Atlas of Ifugao," funded by the National Science Foundation through Yale University.

LEGAL ENTANGLEMENTS AND FINANCIAL PERIL

The stage for the events of 1977 was set in 1975, when the Society recognized that its endowment and other funds were no longer sufficient to maintain the AGS Library and Map Collection. Just days before the Collection was to be closed, the National Geographic Society awarded the Society a Public Service grant which enabled basic library services to continue. Shortly thereafter, the Society suspended all of its nonessential activities and concentrated on providing basic library services and on preserving the AGS membership base through publication of the *Geographical Review* and *Focus*.

Early in 1976 the Society undertook to find a permanent solution for its long-standing financial crisis. A Council-appointed Search Group, supported by a timely travel grant of \$7,500 from the Andrew W. Mellon Foundation, sought either to raise the multimillion-dollar endowment which would enable the Society to continue to support the Collection or to arrange a mutually beneficial association between the Society and some other, preferably New York-based, institution. Hope for the former soon faded; hope for the latter died in the summer of 1976, when the New York Public Library, among other institutions, informed the Society that it did not have the money to support the AGS Collection. However, the Search Group received several excellent offers of association from elsewhere in the nation.

After discussions with almost two dozen institutions, the Search Group concluded that the invitation tendered by the University of Wisconsin-Milwaukee was the strongest. An agreement was negotiated, and in the fall of 1976 both the AGS Council and the University of Wisconsin Board of Regents approved the arrangements. Under the terms of the agreement, title to what will be known as "The American Geographical Society Collection of the Univer-

sity of Wisconsin-Milwaukee Library"—some 184,000 books, 5,500 atlases, 347,000 maps, 33,600 pamphlets and documents, 45,000 photographs, and 65 globes—will be transferred to the University of Wisconsin Board of Regents. In return, the University of Wisconsin pledged a minimum annual operating budget of \$270,000 for the AGS Collection and guaranteed to pay the costs of equipping the UWM Library space for the Collection (estimated at \$229,000) and of moving the Collection from New York to Milwaukee (estimated at \$200,000).

The AGS Collection will be housed as a separate unit in a 33,000-square-foot wing of the UWM Library. Ample work space will be available in the area allotted to the Collection, and a telephone tie-line will be set up for AGS Fellows and other users in New York City. The many rare items in the Collection will be restored; and preservation, binding, and repair will be an important part of the program. The Research Catalog will be expanded, and efforts will be made to increase the circulation of *Current Geographical Publications*. All in all, with its expanded staff and services the Collection will be far more accessible, even to users in New York, than it is at present.

In a separate but related action the AGS Council voted to relocate the Society's headquarters and other functions to Milwaukee. Tentative plans were made to rent office space for the Society on the University of Wisconsin-Milwaukee campus. The Society's building at Broadway and 156th Street, New York City, was subsequently offered for sale. Months may elapse before a buyer is found, however, so other means of disposition are also being considered.

Because the Society is a not-for-profit corporation chartered in New York State, the AGS-UWM agreement cannot become effective until permission to move the AGS Collection out of New York City is granted by the Supreme Court of the State of New York. The necessary legal proceeding requires prior notification of the New York State Attorney General. Even before the Society's petition to the Supreme Court was formally filed in February, 1977, the Attorney General's office took an active interest in the case and contacted numerous institutions to see whether a home could be found for the Collection in New York State. The New York Public Library reentered the picture by signaling its willingness to receive items in the AGS Collection.

The Society concluded that its duty to the Collection and to the community of geographers, not to mention its agreement with the University of Wisconsin, made it impossible to accept the proposal of the New York Public Library. The Public Library candidly admitted that it could not afford to keep the AGS Collection intact as a special geographical library or to continue the Research Catalog or *Current Geographical Publications*. In order to be able to accept the Collection, the New York Public Library would have to disperse items from the Collection throughout its existing holdings and to sell duplicated items.

Months of preparation for the Supreme Court hearing ensued. Because of the increasing complexity of the case, the Society retained a prominent librarian as consultant and adviser. Jack Dalton, former Director of Libraries at the University of Virginia, Professor Emeritus and former Dean of the School of Library Services at Columbia University, and now Director of Columbia University's Library Development Center, undertook a thorough and impartial examination of the AGS Collection.

Mr. Dalton concluded that the amount of overlap between the Society's holdings and those of the New York Public Library appeared to be much greater than the estimate of 30 to 45 percent upon which the Public Library's proposal was based. To substantiate Mr. Dalton's opinion, representatives of the Attorney General's office drew random samples of catalog cards for the Society's books, periodicals, atlases, sets of maps, and single maps and checked them against the Public Library's holdings. At year's end the results were being analyzed and rechecked, but early indications are that in some categories the overlap is at least 70 percent.

As time passed, it became increasingly evident that the delay in transferring the Collection could lead to bankruptcy, because the extraordinary expenses were rapidly depleting the Society's reserves. Although cutbacks in personnel and other austerity measures reduced the Society's total deficit for the fiscal year ending June 30, 1977, to less than half that of the

preceding year (\$74,004, as compared with \$195,600), by the end of the calendar year the financial picture was bleak indeed. Even the generous contributions toward general support in 1977 by 82 individuals (more than \$9,700) and by organizations (\$2,500 from the U.S. Steel Foundation and \$1,000 from the Amax Foundation), a legacy of \$2,500 from Eli Kirk Price III, and income for projects and from other sources (more than \$20,000) could not offset the costs of maintaining the Collection and publishing *Current Geographical Publications* during 1977 (approximately \$44,000) and the legal fees (more than \$75,000). Forecasts of cash flow indicated that the Society would not survive on its present course beyond April, 1978.

Several factors—including the cross-check of the Society's holdings with those of the New York Public Library, the Society's financial peril, the fact that neither the Society nor the Attorney General's office wanted the litigation to result in the demise of the Society, and the recognition by the Attorney General's office that the Society is a valuable educational and scientific asset to New York—led in December to a singular opportunity to resolve the legal issues, to preserve the Collection, and to save the Society. One critical element in the compromise is the willingness of the Society to retain its headquarters and operations in New York instead of moving them to Milwaukee. Another essential element is the assurance of a sound future for the Society, a future free of financial losses such as those it has incurred as a result of the Collection.

Yet these factors alone are not sufficient. Because its financial reserves have been depleted by the delay, the Society cannot prosper unless it receives a substantial infusion of transition funds. Consequently, in mid-December, at the urging of the Attorney General's office, the Society undertook an interim fund-raising effort. By the end of the month two large and distinguished organizations had indicated their willingness to recommend grants to the Society totaling \$200,000, contingent upon receipt of court approval of the transfer of the AGS Collection to the University of Wisconsin-Milwaukee. Prospects for obtaining additional funds looked bright.

THE FUTURE OF THE SOCIETY

Even though this report focuses on 1977, it is appropriate, in view of the importance of a secure future to the resolution of the legal issues, to outline the plans that have been developed for the Society. The need for geographical information and skills is greater today than ever before, and the Society, with its new lease on life, will continue to play a vital role in meeting that need.

In the next year or two the Society expects to increase or initiate activities in six major program areas: Publications; Vitabank (computerized curriculum vitae); Research; Seminars; Field Study; and Non-Print Media. Selection of the programs was based on several criteria. First, the programs must advance the discipline of geography and, whenever possible, serve as bridges among scholarly, business, media, and government communities. New activities must flow from and be compatible with the *Geographical Review* and *Focus*, the Society's core functions, which will continue to be of paramount importance. Old and new activities must form an interrelated and cumulative set of programs which will produce multiple benefits. They must also be financially self-sustaining or have the potential for yielding a surplus.

THE PUBLICATIONS PROGRAM

Both the *Geographical Review* and *Focus* are self-supporting and healthy, but the wounds of retrenchment must be healed. To maintain the high international reputation of the *Geographical Review*, additional editorial and cartographic personnel will be hired. Promotion for both *Focus* and the *Geographical Review* will be intensified in conjunction with general Society efforts to increase membership and visibility.

The Society's three other periodicals will also receive attention. Although responsibility for *Current Geographical Publications* will be transferred to the University of Wisconsin-Milwaukee, cooperative arrangements with the Society will be developed. Similarly, the Society expects to

work with the Scripta Publishing Co. to expand the circulation of *Soviet Geography* and *Polar Geography*.

As soon as possible, the Society will reactivate its newsletter, dormant since 1974. The newsletter will be a vehicle for rapid, inexpensive communication of Society news and events. It will be distributed regularly to all Fellows, to geography departments in the United States, Canada, and selected other nations, to geographical societies around the world, to Congressmen, Senators, and other government officials, to leading businessmen, and to funding agencies.

Reactions to the pioneering "Applied Geography" section in the *Geographical Review* have been positive, and many articles and other manuscripts have been submitted for publication. It is thus timely to investigate the feasibility of launching a separate "Journal of Applied Geography."

The possibility of creating specialized newsletters is also being explored. One of these, a "Business Bulletin," will present crisp, timely reports on topics and regions of interest to businessmen who deal with man and the land.

THE VITABANK PROGRAM

This is, in a real sense, the formalization of a network and set of activities that have existed at the Society for years. It consists in matching those who possess geographical knowledge and skills with those who need geographical knowledge and skills. The present informal system will evolve into a file of curriculum vitae, parts of which will be precoded for eventual computerization. The Vitabank will be used for many purposes, both nationally and internationally: job placement, guest speakers, consultants, expert witnesses, referees and reviewers for the Society's periodicals, and so forth. For geographers, it is a unique concept; nothing as all-encompassing, far-reaching, and streamlined now exists.

THE RESEARCH PROGRAM

Given the Society's New York location, its access to corporate leaders, and its need to maintain a sound financial basis, emphasis is initially being placed on contractual research. Discussions have revealed both a need among businessmen for research reports on geographical topics (such as the distribution of mineral resources and transportation networks) and an eagerness on the part of geographers to join specially assembled research teams.

In addition to contractual research, the Society is investigating the feasibility of expanding its cartographic and basic research interests. One avenue for this would be resumption of work on a proposal for a "Vegetation Atlas of Protected Areas," with Professor A. W. Küchler of the University of Kansas as principal investigator. Preparation of a proposal for the project was funded by the Rockefeller Foundation, but work on the atlas itself was not begun owing to the curtailment of the Society's research activities in 1976.

THE SEMINAR PROGRAM

Several types of gatherings are envisioned—lectures, symposia, workshops, minicourses, training sessions, and other opportunities for continuing education. To date attention has focused on seminars for businessmen given by distinguished geographers and other professionals. The challenge is to select a timely topic with wide appeal to specific target audiences and on which stellar speakers are available, such as "The Middle East: The Climate for Business Investment," "The Antarctic and the Energy Crisis," or "The Sun Belt: Plant Location." Once the system is fully operational, the Society expects to offer seminars on a regular basis and to repeat them as appropriate across the United States and Canada.

Whereas the seminars will be designed primarily for nongeographers—businessmen, government officials, and media professionals—training sessions or workshops will be designed to improve the skills of professional geographers themselves. The central purpose of these workshops will be to present new geographical techniques and methodologies, but there is also a

widespread need for polishing basic skills, such as the preparation of articles and the writing of research proposals.

FIELD STUDY AND NON-PRINT MEDIA PROGRAMS

So far, attention has been directed mainly to activities in the four program areas in which needs and opportunities are the greatest, in which the Society has the greatest capabilities, and in which yield on investment is likely to be greatest. As compelling opportunities arise in the program areas of Field Study (school field trips and national or international study tours) or Non-Print Media (films, slides, television, and radio) they will be considered, as long as they serve the Society's basic objectives.

IN APPRECIATION

Without teamwork and dedication, the legal tensions and financial uncertainties of the early months of 1977 could not have been transformed into the cordial, optimistic mood of the latter part of the year. The list of individuals and organizations to whom the Society owes its thanks is long, and rightly so.

Our greatest debt is to the Society's staff and volunteers, who performed their duties superbly amid unprecedented adversity and cheerfully shouldered new burdens. For accomplishment in the face of seemingly insurmountable obstacles no one surpasses Roman Drazniowsky, Map Curator and Librarian, assistants Brunhilde Mühlböck, Monika Murphy, and Alexej Delakowski, and volunteers Paula C. Comans, Dorothea Hanatschek, Susan Muntz, Mary Ann Whitney, and Ann Yarmel.

The high editorial quality and on-time appearance of the *Geographical Review* were due mainly to James I. Bauer, who assumed increased responsibility for producing the journal, and to Douglas R. McManis of Teachers College, Columbia University, who volunteered yet another year of his services as Book Review Editor. And special note must be made of the essential but seldom heralded contributions of Mary E. Stavrou, administrative assistant, Henny Gribbin and Elizabeth White, bookkeepers, Selma Landsberger, sales manager and receptionist, Miguel Villeda, circulation manager, and Rafael Castro, custodian.

Two of the Society's longtime staff members retired in 1977. To Alice Taylor, who launched *Focus* twenty-seven years ago and served as its Editor ever since, and to William Fischer, who ably shepherded the multifaceted operations of the Business Office for eight years, go the Society's thanks for having remained beyond normal retirement and our best wishes for health and happiness in the years ahead.

Two major staff appointments were made in 1977. In July the editorship of *Focus* was assumed by David Hapgood, journalist, author of several books, and former Fellow of the Institute of Current World Affairs. Mr. Hapgood settled into the *Focus* routine so smoothly and became one of the AGS team so quickly that he earned the admiration of all. In October the Society was strengthened further when Alexander F. Draper joined the staff as Deputy Director. Mr. Draper's extensive experience in business and non-profit management and in corporate development has already proved invaluable in his stewardship of the Society's administration and development.

Throughout the year the officers and Councilors of the Society were exemplars of solidarity and fortitude. Serge A. Korff, cornerstone of the Society since 1957, remained as Chairman; and Richard H. Nolte served for another year as President and pilot. Julian Wolpert was elected to the Vice-Presidency, left vacant by the death in late 1976 of longtime Councilor Boris Pregel. Donald J. Lloyd-Jones continued as Treasurer and Douglas R. McManis as Secretary. My only regret during the year was the resignation on February 7 of Thomas F. Malone, whose forthright advice on editorial matters was always appreciated. To him and to each of the other Councilors I say, as I have so often, "Thank you."

High honors for patience go to Chancellor Werner A. Baum of the University of Wisconsin-

Milwaukee and to his faculty and staff, particularly William C. Roselle, Director of the UWM Library, and Barbara Borowiecki, Chairman of the UWM Department of Geography. Their interest in the AGS Collection and their encouragement of the Society in its efforts to obtain legal clearance for the transfer never wavered through what must have seemed an endless year.

Patience and persistence also characterized the Society's outstanding legal team. Only the diligence and legal prowess of Maximilian W. Kempner, John E. Gould, and Charles T. Lee, the generous assistance of their numerous colleagues in the law firm of Webster & Sheffield who worked on the AGS case, and the wide-ranging services of the expert witnesses could have guided the Society so safely through the maze of litigation.

That the Society's plans for a New York-based, financially stable future show so much promise for success is due to the countless people—geographers and nongeographers alike—who shared their wisdom, expertise, and enthusiasm with the Society's staff. At this point we can do little more than acknowledge our debt to these friends; but we shall dedicate ourselves in coming years to living up to the faith they have shown in the Society.

I close with one final word of appreciation: to the office of the Attorney General of New York State. Although at first their opinion of what was in the Society's best interests differed vastly from that of the AGS staff and Council, over the long months of pretrial discovery the paths to our common goal converged and a spirit of cooperation emerged. Out of this cooperation grew the impetus to seek transition funds and to develop new programs on a scale not envisioned a year ago. Yes, 1977 was the year in which the Society turned problems into opportunities.

SARAH K. MYERS
Director

GEOGRAPHICAL REVIEWS

FOOD CROPS OF THE LOWLAND TROPICS. Edited by C. L. A. LEAKEY and J. B. WILLS. xiv and 345 pp.; maps, diagrs., bibliogrs., index. Oxford University Press, London and New York, 1977. \$19.75. 10 x 7½ inches.

A series of twelve seminars from 1970 to 1972 on various aspects of West African agriculture was sponsored jointly by the Ford Foundation, the Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières (IRAT), and the nascent International Institute of Tropical Africa (IITA). "Food Crops of the Lowland Tropics" derives from those seminars. Some of the fifteen chapters are based almost entirely on the seminar papers, are essentially summaries of them, and contain many statements uniquely dependent for their authority on the unpublished and relatively inaccessible papers. The book's better chapters draw on a wider literature to make independent contributions. The volume does not attempt to be comprehensive, and the editors have permitted varied structure and coverage in order to accommodate the diverse approaches of the authors. A special merit of the book, as of the seminars, is that it brings together results of agricultural scientific research from Anglophone and Francophone West Africa, and several of the chapters are the joint products of British and French scientists. Agricultural economic research findings unfortunately are not included. Most of the authors were on the staff of IRAT or IITA, of a French or British government agency, or of a university at the time of the seminars. Only two held positions in West African universities (Ibadan and Ife).

A brief chapter on research strategies written by the directors of IRAT and IITA introduces the book. The first six substantive chapters concern specific African food crops or groups of food crops—rice, sorghum and pearl millet, grain legumes, roots and tubers, and vegetables. There is a short chapter on bananas, and one on forage and fodder crops. The last half of the book consists of seven chapters on agricultural practices and organization. Topics covered include irrigation, pests, diseases, grain storage, mechanization, agricultural systems, and land tenure. There is also a three-page appendix on maize, which was not a subject of the seminars. The editors did not include a chapter on soils, which was the subject of a seminar in 1972 because a book on that subject was published in that year ("Soils of the Humid Tropics," *Publication 1948*, National Academy of Sciences, Washington, D.C., 1972).

Some of the chapters in this collection fully achieve the editors' avowed intention "to make available to researchers, agricultural educators, and agricultural administrators a body of knowledge . . . that would serve as a library tool and desk reference for professionals in the field," but the book as a whole falls short of becoming a comprehensive reference on food crops and food-crop research for tropical Africa.

The chapters of most general interest are probably those on traditional agricultural systems, fodder and forage crops, and irrigation. They are among the best in the book in coverage, organization, and insight. The chapter on mechanization, also a topic of general interest, consists of a poorly informed survey of the use of animal and mechanical traction in some West African countries and of undigested summaries of papers written for one of the seminars.

R. Tourte and J. C. Moomaw present excellent descriptions of various African farming systems and expound the advantages of mixed farming as an intermediate step in agricultural development, particularly where land is relatively scarce. They review experimental data that show the importance of deep tillage in the development of a soil structure that is more conducive to rooting and to ensuring a better supply of water and minerals to the plants. They also cite work by C. Charreaux in the Casamance district of Senegal that demonstrates how plowing can reduce run-off and erosion. Without ignoring the influence of relative factor costs, they build a logical sequence for agricultural evolution from hoe farming to tractorization and irrigation on agronomic arguments alone.

L. V. Crowder and H. R. Chheda provide a broad review of animal-feeding problems in the various agroclimatic zones of West Africa. They say that the most important single cause of low

livestock production is probably the lack of adequate year-round nutrition. The nutritive value of most native grasses is poor and declines sharply in the dry season when low content of crude protein further limits animal performance. They find advantages in mixed farming but believe that only time and education can bring about the changes in socioeconomic structure and ways of life that such a system requires.

In a splendid review of West African irrigation, actual and potential, D. des Bouvrie and J. R. Rydzewski caution that most West African soils are not well suited to irrigation, although West Africa's surface water resources are large. The light soils of the savanna have low water storage capacity; ground-water laterites impede drainage, and black cotton soils like those on the Accra plains are excessively sticky and slowly permeable. In spite of the region's general lack of irrigation requirements, Bouvrie and Rydzewski find potential for it in the lower Senegal, in the interior delta of the Niger, and on the shores of Lake Chad. Limited ground-water resources offer attractive opportunities in some areas. The authors point out that exploitation of ground water permits gradual development to irrigation, and thus eases the learning process for farmers. Users of ground water are also free from the serious health hazards of onchocerciasis and schistosomiasis that are encountered when surface water is used.

Other chapters that merit special notice are ones on insects and mite pests and their control by W. K. Whitney, on disorders associated with fungi, bacteria, viruses, and nematodes and their control by M. Delassus, on rice by R. Chabrolin, on grain legumes by K. O. Rachie and P. Silvestre, and on roots and tubers by D. G. Coursey and R. H. Booth. The chapter on rice is especially remarkable for its account of the characteristics of *Oryza glaberrima* and of its crosses with *O. sativa*, a matter too much ignored by English-speaking agronomists; and the chapter on grain legumes is praiseworthy for its documentation of cowpea research.

The chapter on grain legumes reaches the surprising conclusion that the slow growth of world markets for oils and oil seeds is an obstacle to increasing the production of groundnuts (peanuts), one of West Africa's major commercial crops, while the authors urge expanded planting of soybeans for export, a crop for which there is no local demand at all.

The chapter on roots and tubers is a solid professional account of an important group of West African starchy staples. It is surprising, however, to find Coursey and Booth falling into the error of treating sweet potatoes as an important West African crop and repeating B. Beck's confused statements about the introduction and spread of cassava (manioc) in Africa. It is unfortunate, also, that they omitted an account of the encouraging breeding and selection work with manioc and yams carried out by S. K. Hahn and S. Sadik at IITA and of V. A. Oyenuga's extensive studies at the University of Ibadan of the use of manioc as cattle feed.

There is no chapter devoted specifically to fertilizers, but a wealth of information about their use is to be found throughout the book. The principal message of these scattered statements is the need to consider carefully both the nature of each crop's mineral requirements and the character of farming methods in general use before embarking on a fertilizer program.

There is much more of interest in the book, including the chapters that have not been mentioned specifically, and there are also more things to criticize. The book promises in its title much more than it delivers, and the long delay in publication has resulted in the omission of reports of research since 1971 or 1972. But the book will be useful to West African specialists, especially if IITA can realize its intention to prepare subsequent editions from time to time.—
WILLIAM O. JONES

THE OUTSIDERS: The Western Experience in India and China. By RHOADS MURPHEY. xiv and 299 pp.; maps, diagr., ill., bibliogr., index. The University of Michigan Press, Ann Arbor, 1977. \$16.50. 9¼ x 6¼ inches.

A large literature has accumulated on the politicoeconomic expansionist activities of the West and the interrelations between West and non-West. Many of these studies constitute outright attacks on the capitalistic economic and political exploitation by the West. Broader viewpoints take the form of historical analyses of the ways in which the affected societies have responded

and reacted. "The Outsiders" falls into the latter category. Even in its restrained analysis, however, the volume is an indictment of the egoistic ambitions of Western merchants who tried to bring the East out of its tradition-bound economic world. Murphey's book presents an assessment of the interplay between politicoeconomic pressures by the West and the reaction patterns of the two largest units of the East, India and China. Only peripheral glances are cast at Southeast Asia and at Japan.

Murphey sees the early penetration of India as the opening effort in what quickly came to be a "grand colonial design." The founding of international trading centers at port cities was aimed at transforming the traditional inward-facing economies into international market economies dominated by technologies, facilities, and energies of Europeans for the supposed profit and cultural advancement of both sides. India was politically disorganized and seeking socioeconomic redevelopment when the Europeans appeared, and the British took the lead in realignment. Many Indians, discouraged by the weaknesses of their socioeconomic systems, became sympathizers with or supporters of British efforts to restructure both the internal and the external aspects of Indian life. As Murphey sees it, colonial port dynamics did transform the Indian administrative and economic systems. A hybrid culture system has emerged in which the inherited colonial institutional structure inhibits true modernization, and the domestic levels of living for Indian rural villagers have lagged.

As interpreted by Murphey, an early degree of success in India led the West to try the same process in China. However, an early sense of frustration over the inability of the West to penetrate effectively and to reorient Chinese economy resulted and has remained to the present. The earliest treaty-port concessions followed the Indian pattern, and, although there came to be far more treaty-ports than in India, control over Chinese affairs and business practices eluded the European grasp. China has retained control over its economic life because domestic trade has always outrun foreign trade, and most of the latter remained under the control of Chinese agents of foreign interests.

For some years Murphey has been investigating the colonial port city and the treaty-port theme, and portions on China in the book have appeared previously. His approach has a sound rationale, since it was in the port cities that the Europeans gathered, built their settlements, and made efforts to demonstrate the validity of their politicoeconomic system. It continues to be in the huge modern cities that much of the intercultural dynamics is manifested. The book focuses largely on the theme of economic development, and the cultural dynamics are to some degree inferential. From the viewpoint of coastal establishments, Murphey's conclusions are valid ones, and the materials are well marshaled to support his case.

Within the limits of a moderate-length volume, after long research, and with maps and a good bibliography, Murphey has purposely attempted broad generalizations rather than a total assessment of the impact of the West on the East. His conclusion, that India was brought into the international orbit whereas China remained largely outside it and in control of her own economy, is sound and well argued. Such an approach, however, focused as it is on the port cities and international commercial rivalries, simply cannot also measure the undramatic elements of cultural changes that were taking place in both countries among the lesser citizenry that was left almost entirely to its own devices.

One must remember in reading this volume that things were happening in the interiors, in the villages and small towns where most of the people lived during the centuries under review. There cultural influences penetrated in inadvertent, intangible, and diffuse ways that do not turn up in this volume, for they are outside its intended scope.—J. E. SPENCER

BARBARIANS AND MANDARINS: Thirteen Centuries of Western Travelers in China. By NIGEL CAMERON. 443 pp.; ill., bibliogr., index. The University of Chicago Press, Chicago, 1970, 1976. \$7.95 (paperbound). 9½ x 6½ inches.

The Chinese have never had much interest in receiving visitors from the West. From the symbolism of their nation as manifest in its name—the Middle Kingdom—to the explicit

disregard for the majority of the goods that Western travelers carried into China, the Chinese have at best tolerated foreign cultural intrusions. There were exceptions, but fundamentally the Westerners trying to woo, cajole, or force China into international cooperation have been unsuccessful. Passages from the famous letter of Emperor Ch'ien Lung to King George III of Great Britain illustrate Chinese disinterest in foreign things and people.

Swaying the wide world, I have but one aim in view. . . to maintain a perfect governance and to fulfill the duties of the State; strange and costly objects do not interest me. . . we possess all things. . . I set no value on objects strange and ingenious, and have no use for your country's manufactures.

Nigel Cameron has written a very readable commentary on the efforts that Westerners—mostly in the form of Catholic and Protestant missionaries—made to show the Chinese that they did not possess all things. Beginning with the T'ang Dynasty and the Syrian traveler Alopen, credited as being the first Western visitor to China where he established a Nestorian church in Ch'ang-an, Cameron chronicles Western efforts until the end of the Boxer Rebellion in the early years of the twentieth century. That suicidal effort by the Chinese to eradicate all evidence of Western intrusion is a fitting end for Cameron's study of "Barbarians and Mandarins" because the tenor of his observation (from the European point of view) is pessimistic. He interprets the Chinese as feeling little need for the offerings of the emissaries who came to China during the thirteen centuries covered by this study. Cameron also considers the West to have been naive in what was learned from the China experience. His work adds substance to an interpretation of a mission doomed at the outset, but he does not give as much coverage to the "barbarous attacks of the early Iberian traders" as he does to the courtly machinations of the Chinese and foreigners alike during the centuries of attempted liaisons at the imperial court. To this end, more of the book is given over to the discussion of the kowtow (head-knocking bow required of all who seek and gain the presence of the Chinese emperor) than is allotted to discussion of actual trade relations and goods exchange.

For the geographer, Cameron has captured some scenes of great value in the struggle to see the Middle Kingdom as the earliest Westerners saw it. There is a fine description of Friar William's observations in the middle of the thirteenth century when he witnessed the arrival, establishment, and functioning of a mobile yurt encampment of a Mongol tribe. The Friar further described the material culture of the mobile Mongols, and Cameron includes numerous examples of such wonders as the notation by Friar William that he himself "has counted twenty-two oxen drawing one house. . . . The axle of the cart was as large as the mast of a ship, and one man stood at the entry of the house on the cart, driving the oxen."

In describing one of the most successful entries made by the West into the court of China, Cameron discusses in great detail what he calls "The Grand Alliance" of Ferdinand Verbiest and K'ang-hsi of the early years of the Manchu court in Ch'ing Dynasty. In an unparalleled closeness between Westerner and the Chinese emperor, Verbiest became privy to virtually all aspects of the court. The detail with which this episode is treated is typical of the wealth of information from travelers' journals that may be found in Cameron's book.

Cameron has shown his affection for the Chinese experience in his earlier works and his initial journalistic writing for the London Daily Mail in the mid-1930's. This book puts the dozens of European and American missions in perspective. However, a geographer, for example, might regret that so much space is given to foot binding and its sexual overtones or that a person such as the engineer O. J. Todd is overlooked entirely, but images of Canton in 1517 and of Peking in the 1720's and the 1860's make the book quite definitely worth reading.

There is another perspective that must be included in my particular comment on Nigel Cameron's work. In his discussion of the means of housing the Western travelers in the sixteenth century he notes

In due course the embassy [that of Tomaso Pires] was accepted by Peking, and word was sent ordering it to proceed, by an exactly specified route, to the capital. Arriving

there, all embassies were quartered in a compound together, irrespective of whether they came from some tribal chieftain or from the most powerful king in Europe.

As I sit in my hotel room in the Peking Hotel, overlooking the grand skyline of the crescent eaves of the Forbidden City and the massive space of Tien An Men Square, I wonder at the nature of the progress Western travelers made in the thirteen centuries encompassed by "Barbarians and Mandarins." Although Friar Verbiest made history by being led at dawn through the monumental gateways of the Ming Palace complex, I was simply one among many who walked through the identical portals at dawn three centuries later. Quarters for all foreign guests continued to be isolated so that they could enjoy air conditioning in the new wing of the hotel. Like so many of the people in the Chinese drama interpreted by Cameron, I had a feeling of awe and excitement at being in China, in Peking, and most assuredly, within the confines of the Forbidden City. But, like Cameron's people, when I try to assess what has been given, what has been gained in coming to the heart of China, I have an uneasy sense that no foreign influence will significantly affect the Chinese essence. Even though new edicts call for exchange of technology and increased travel and communication between the People's Republic of China and the outer world, a strong sensation of the Chinese belief that "strange and costly objects do not interest [us]. . . . We possess all things" persists. Cameron's book does a brilliant and thorough job of illustrating how minimally the West has been able to convince the Chinese otherwise.

Thinking of this theme as I descended in a Chinese-made elevator and was escorted into a Chinese-made car for a carefully guided tour of a 70,000 person workers' apartment complex, I felt that history was being prepared for an additional volume of Western efforts to involve China more closely with Western ways and wants. The outcome is far from certain, but Cameron's work is probably a most fitting shadow of things to come.—CHRISTOPHER L. SALTER

URBANIZATION IN THE MIDDLE EAST. By V. F. COSTELLO. ix and 121 pp.; maps, diagr., bibliogr., index. Cambridge University Press, Cambridge, London, and elsewhere, 1977. \$11.50 (clothbound); \$3.95 (paperbound). 9 $\frac{1}{4}$ x 6 $\frac{1}{4}$ inches.

This slim book, part of a new series on urbanization in developing countries designed primarily for undergraduates studying social change, is one of the first attempts to synthesize the social, demographic, political, and economic processes involved in Middle Eastern urbanization. Costello includes only the countries from Libya to Iran, with the justification that they constitute, or have "intimate geographical links" with, the core area of the Middle East. However, culturally and historically it is incorrect to exclude other peripheral countries. Tunis, Fez, Tlemcen, and Herat are certainly Middle Eastern cities.

Costello's purpose is "to describe how the life of the traditional Middle Eastern city has been transformed by modern physical and social urbanization." The traditional city is described as the Islamic city, a stereotyped concept that he accepts uncritically. The long and important pre-Islamic heritage of Middle Eastern urbanism is ignored, and the religion of Islam is erroneously considered the primary influence on the development of cities. A basic premise of the work, that urban development is growing from common origins throughout the region, ignores the cultural and historical diversity of the Middle East.

In spite of the limited number of pages, the breadth of coverage is extensive; but such coverage eschews any in-depth analysis. For example, the chapter on "Occupations and Social Stratification" has fifteen pages. "Social Adjustment in the City," seventeen, and "Rural-Urban Migration," only eleven. Examples from various countries are rather uneven in their coverage: Iran is used most frequently, reflecting the author's greater familiarity and experience with this country. The best chapter is perhaps the one on urban form and structure, in which Costello briefly but adequately contrasts Kashan, Cairo, Beirut, Kuwait, and Tehran. Sections of other chapters are excellent. These include the discussion of the causes of migration, overurbanization, the parasitic city, and city size and economic development. On the other

hand, the sections on urban population growth, fertility rates, and sex ratios are tedious statistical renditions in which much of the material could have been presented more clearly in tables.

The weakest aspect of the book concerns social urbanization. Anthropologists and sociologists will readily identify the simplistic notions of society and religion. Clichés are used to describe the traditional urban society of the Middle East, often with the incomprehensible involutions of the sociologist, C. A. O. van Nieuwenhuijze. Erroneous statements also abound in descriptions of nomadism, tribal structure, the family, Islam, and the role of women. Throughout the book are statements that may be questionable or at least ought to be qualified. To give only one example: "The Ottoman Turks eradicated all traces of pre-Islamic non-Turkish urban life in Anatolia."

The appendix, which might have been a useful comparison of individual countries and cities in the Middle East, lists instead the total population and the urban percentage of selected countries of the world but does not state that the definition of "urban" may vary from country to country. Population estimates from the Arabian peninsula would have been valuable, as would other statistics on Middle Eastern cities or countries, such as fertility rates or urban growth, some of which were discussed in the text. A major limitation of the book is that only a small body of English works has furnished all of the case studies and examples. Works in French and German on Middle Eastern cities are ignored, as are vernacular language publications—an especially important oversight in the case of Turkey.

Costello must be commended for writing one of the first overviews of Middle Eastern urbanization. Yet, as part of the new series on urbanization in developing countries, it perhaps would have been better to have either limited the work to fewer countries or narrowed the topic considerably. Costello's experience in Iran alone could have provided the material for an in-depth volume. Alternatively, a work on rural-urban migration, adjustment to urban life, or some other aspect of the process of urbanization in the Middle East would have constituted a more viable book. Such volumes might have been more useful, even for the undergraduate student.—MICHAEL E. BONINE

SACHA RUNA: Ethnicity and Adaptation of Ecuadorian Jungle Quichua. By NORMAN E. WHITTEN, JR. xviii and 348 pp.; maps, diagrs., ills., bibliogr., index. University of Illinois Press, Urbana, Chicago, and London, 1976. \$12.50. 9¼ x 6 inches.

Geographers have given considerable attention to the spontaneous and the government-sponsored efforts to colonize the vast, sparsely populated lands of the Amazon Basin. However, relatively little study of the impact of these intrusions on the indigenous people has been made. "Sacha Runa," written by a noted anthropologist, Norman E. Whitten, Jr., with the assistance of Marcelo F. Naranjo, Marcelo Santi Simbaña, and Dorothea S. Whitten, is one of the few accounts to focus on the culture being altered rather than on the initiators of change. The Canelos Quichua of Ecuador are examined by Whitten and his associates, and a major theme of the book is the intimate relationship between the Canelos Quichua and their tropical-forest environment. Their understanding of the dynamics of tropical-forest ecology, Whitten argues, could well be utilized by the government for a more rational attempt to colonize and exploit the Upper Amazon. The Puyo Runa, a territorial group of the Canelos Quichua, are cited as an example, but the author fails to present a detailed account of the man-land relationships involved. A brief description of their subsistence economy is found in chapter three, but such basic information as size of clearings, densities of population, labor inputs, or dietary composition is omitted. The Puyo Runa have a rapidly expanding population; nevertheless, little is written about the implications for their subsistence base, especially in terms of its diminishing area as colonists and companies penetrate the group's territory. In contrast there is an abundance of details on social structure, symbolism, rituals, and communication of knowledge. Although Whitten is often vague on the relationships between way-of-life and adaptation to changing circumstance, he does demonstrate how indigenous concepts are manipulated to cope

with an invasion of alien ideas that seek to destroy the culture—a process that he terms “ethnocide.”

Perhaps the most interesting and the most readable chapters in the book are the final two in which the author documents recent encroachments by colonists, oil companies, and urban centers. He deftly outlines the vacillating attitudes and contradictory policies of the government toward the Amazon since the 1930's and concludes that under present policies the only way that Ecuadorian Amazonia will be incorporated economically and socially into the country as a whole will be at the expense of the Canelos Quichua way of life.

There is a tendency in the book to look at the culture of the Amazonian Quichua solely from the inside. Many of the Puyo Runa worked for the oil companies, and many of their leaders developed contacts with various individuals and groups outside their region. However, we read little of the extent and influence (if any) of Puyo Runa individuals or communities outside their culture area. It would have been interesting to know to what degree they are participating in the increased population mobility that characterizes so much of Andean and Amazonian America. Ethnicity is usually forged outside the culture area, and especially in the city, and one constantly wonders what the wider context of the Canelos Quichua actually is.

The author clearly liked the people whom he studied, and he sympathizes with—and at times romanticizes—their threatened way of life. He is aware that their knowledge of habitat could significantly help the government in a rational exploitation of the rain-forest environment. However, he is pessimistic that this will occur, and one of the stated aims of the book is to present the case for the Puyo Runa to a literate world. Unfortunately, this goal is not helped by a tortuous writing style. Even with allowances for a certain amount of sociological jargon, much of the value of the book is diminished by an indiscriminate use of words that produces imprecision and confusion in the mind of the reader.

Despite its shortcomings the book does provide data on the Puyo Runa as they exist. If the author's conclusion is correct and their culture is destroyed in the near future, a later generation of Amazonian Quichua will be able to use the book to see what their culture was like.—RONALD SKELDON

THE CHANGING SHAPE OF METROPOLITAN AMERICA: Commuting Patterns, Urban Fields, and Decentralization Processes, 1960–1970. By BRIAN J. L. BERRY and QUENTIN GILLARD. 697 pp.; maps, diagrs. Ballinger Publishing Co., Cambridge, Massachusetts, 1977. \$25.00. 10 1/4 x 7 1/4 inches.

The title of this book precisely states its content but not its format. The volume is an atlas of the commuting fields of 283 central cities in 230 SMSAs as defined in the 1970 census. The maps show how the commuting fields have extended and altered in form. They are preceded by a rather brief but insightful text that in part discusses the commuter field data, but more enthusiastically deals with the causes and implications of an increasingly evident population deconcentration beyond what are normally considered to be metropolitan regions.

The atlas consists of six maps for each central city. Two larger maps show the 1970 commuter field and the change in the commuter field between 1960 and 1970. Smaller maps show the commuter field of the CBD in 1970, reverse commuting from the central city in 1960 and in 1970, and the change in reverse commuting between 1960 and 1970. The maps are larger and more detailed than the famous map, “Commuting Fields of Central Counties,” which Berry prepared from 1960 census data for the Social Science Research Council's Committee of Areas for Social and Economic Statistics and for the U.S. Bureau of the Census in 1967. They obviously represent a prodigious amount of data transformation and mapping effort and are designed, I believe, to tempt other scholars into a great variety of comparative and analytical studies.

Yet they will not be easy to use for two reasons. First, in order to avoid clutter and confusion in a one-color map, virtually no guidance is provided of any landmarks or boundaries. Central cities are shaded and interstate highways are shown—not too precisely—but it is disconcerting

not to have state boundaries or major rivers for such complex areas as New York, Minneapolis, St. Louis, or Portland, Oregon to name a few. Second, because the contouring and boundaries were done in a standardized manner by persons probably unfamiliar with local geography, I suspect others will question the accuracy of presentation for their city as I must that of Seattle. It is impossible for the commutershed to have extended deep into Olympic National Park, where no one lives. One almost wishes for a sampling of cities mapped more precisely rather than the more complete but unsure presentation of this book.

Nevertheless, those interested in and concerned with the changing nature of the metropolitan laborshed or the urban field and with the diminishing role of the central city and CBD will find the maps informative and fascinating. To those who are convinced of the superiority of the central city and downtown, the maps may even prove disturbing. Although some younger and smaller cities, especially in the South, exemplify the CBD and central city dominance and the vitality characteristic of rapid urbanization and industrialization, most larger cities, especially the older industrial cities in the Northeast, reveal decentralization manifested by reduced dependence on the CBD and central city for jobs, increased reverse commuting, and a significant extension of the range of commuting. Although it is the CBD and the central city commutersheds that best reveal this deconcentration, one still wishes the authors had also mapped the commuter fields of central counties or even SMSAs, which according to their very arguments must be the more meaningful—especially in the case of the SMSAs with several central cities (all separated in the maps and analysis) like Vineland-Millville-Bridgeton, Brownsville-San Benito-Harlingen, Anaheim-Garden Grove-Santa Ana, McAllen-Edinburg-Pharr, Provo-Orem, Bloomington-Normal, or Champaign-Urbana.

Analysis of the 1970 commuting fields stresses comparison with the 1960 fields by proceeding along three lines. First, a flattened and extended distance-decay gradient is well fit via negative exponential regression and graphs. Then a less successful attempt is made to generalize the more complex curves representing change in dependence on the central city (from less dependence in the city itself to an increase in the inner suburbs to a decrease in the further suburbs and exurban zone). Finally, an intriguing tabular analysis relates changes in the size and shape of the commuter fields and in central city dependence and reverse commuting to such variables as SMSA size and growth, city versus SMSA white, nonwhite, and employment change, and city versus SMSA retail trade. From all these is discerned a tendency for convergence in the form of metropolitan regions that cover much larger areas at lower densities and that have multiple employment centers with the central city being increasingly abandoned to the less successful.

In the more general and speculative chapters the commuter field is seen as one manifestation of counter-urbanization, a reversal of a century of population and employment concentration, whereby the inherent preference of Americans for the countryside can be exercised by more and more people because of improvements in transport, communication, and income. The same forces have deprived the inner city of its superior accessibility with a consequence that the more able people are moving out, while the less successful ones are left fighting as competing cultural camps for limited public resources. This pattern is not comforting, but it must be taken seriously in a nation that is still essentially individualistic.—RICHARD L. MORRILL

MAPS IN MINDS: Reflections on Cognitive Mapping. By ROGER M. DOWNS and DAVID STEA. xx and 284 pp.; maps, diagrs., ill., bibliogr., index. Harper & Row, New York, 1977. \$7.95 (paperbound). 9¼ x 6¼ inches.

New subfields are often introduced to a profession by a collection of essays or reprinted papers. Later a more cohesive treatise may appear. This pattern has been followed by Downs and Stea. First, they edited a reader on cognitive mapping and spatial behavior (*Image and Environment* [Aldine Publishing Company, Chicago, 1973]), and now they offer a skillfully prepared statement on the importance, function, and meaning of cognitive mapping. Although these two

works are as distinct in tone as any reader and treatise may be, the experience the authors gained during compilation of the first book is complemented admirably by the clarity and insight of the second.

The authors are not preoccupied with maps in the traditional, cartographic sense, nor are they attempting an elaboration of Gould's earlier concept of the mental map as the cartographic expression of spatial preference and perception. Their theme is cognitive mapping, and their use of the gerund "mapping" instead of the nonverbal noun "map" in the title reflects a concern with a process rather than a tangible product. Because this process encompasses such seemingly diverse operations as finding one's way around cities, learning the geography of one's surroundings, or communicating knowledge about places—topics until recently accorded comparatively little attention by geographers and psychologists—any expectation that Downs and Stea could provide a definitive treatment would be naïve. The authors recognize this limitation and attempt to promote the understanding of the role of cognitive mapping in a wide range of human activities. In this effort they succeed.

The book's organization is well suited to a topic that is at once obvious and vague. Before outlining the objectives and functions of cognitive mapping, the authors present numerous examples of this process found in cartoons and advertising maps, as well as in the spatial problem-solving of men and animals. Journalism and literature also provide abundant illustrations of place imagery as an effect of cognitive mapping, and the reader cannot avoid being impressed by the importance and pervasiveness of this mental activity, even though a reasonably complete understanding of the underlying cognitive mechanism is, at present, impossible.

Chapter 6 of the book provides a concise summary of relevant psychological literature; relates the work of Bruner, Piaget, and other developmental psychologists to geographical learning and spatial problem-solving; and indicates the need for further study by experimental and theoretical psychologists. The authors, however, continue their speculations beyond such a convenient but otherwise unfulfilling stopping point by discussing more fully the development of cognitive maps for cities and the prescriptive applications of research in cognitive mapping to urban planning, highway design, and cartography.

Although the book will no doubt promote the behavioral approach to geography, perhaps its principal effect will be upon cartography, where there appears to be a renewed interest in training the map user as a means of improving cartographic communication. Because map reading ability is a form of spatial problem-solving, cartography and the study of cognitive mapping have common interests in developmental psychology and the theory of learning. Moreover, because the cartographer's products are intended to aid spatial problem-solving, mapmakers need to understand as fully as possible the appropriate roles of cartographic maps in the larger sphere of cognitive mapping. The deplorable state of American city street maps, which rarely include landmarks that might facilitate finding one's way, is but one example of the gap between user requirements and producer responses. Increased understanding of the spatial aspects of learning and of the needs and limitations of the map user must precede the improvements in cartographic design and graphic literacy required to close this gap. Downs and Stea provide a convenient stimulus for a broader discussion of these questions by researchers and practitioners of cartographic communication. This inexpensive paperback has been edited carefully, is highly suitable for undergraduate courses, and thus should influence a wide audience of future mapmakers and cartographic researchers.

A final kudo is in order. By effective use of exhibits, "Maps in Minds" is a model of geographical exposition. Cartoons, advertisements, maps, and diagrams have been taken from many diverse sources, and the reproductions are sharp and legible. Short quotations from newspapers, magazines, and books are used extensively—but always as relevant examples of the concepts being discussed and never as crutches for a paralysis of thought. These graphic and verbal illustrations are central to the authors' theme of the prevalence of cognitive mapping. For the reader, the result is a delightful and informative experience.—MARK S. MONMONIER

SPACE AND PLACE: The Perspective of Experience. By YI-FU TUAN. ix and 235 pp.; maps, diagrs., ill., notes, index. University of Minnesota Press, Minneapolis, 1977. \$12.95. 9 1/4 x 6 1/4 inches.

"Space and Place" bears such an overpowering familial resemblance to Yi-Fu Tuan's previous book, "Topophilia: A Study of Environmental Perception, Attitudes, and Values" (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1974), that a comparison is inevitable. They share common examples and sources. Even a cursory perusal of indexes and footnotes suggests considerable overlap. One would expect duplication of themes, but the overlap extends to particular anthropological and ethnographic sources that illustrate those themes. The figures reinforce the pattern of resemblance. Of the fourteen figures in "Topophilia," five reappear in "Space and Place." Admittedly, some are improved by redrafting. Moreover, another figure is virtually duplicative, and there are shared elements in two additional instances.

Given this overlap, how can we assess "Space and Place"? Are we confronted with "leftovers" or with a genuine extension of ideas? On balance, the latter is the case. "Topophilia" is a curious book. Interesting, even fascinating in parts, it reads like meticulously organized lecture notes which have been gleaned from the labors of extensive reading. Even the format, with profuse headings and subheadings, suggests a card-file index. "Topophilia" lacks that essential coherence and perspective that we have come to expect from Yi-Fu Tuan. The finale, "Summary and Conclusions," epitomizes what is to me the underlying weakness of the book *qua* book. There is no sense of synthesis, of climax and completeness in this uninspiring précis.

It is no exaggeration to say, as Tuan does, that "Space and Place" contains what "Topophilia" lacks. As befits a book about experience, "Space and Place" offers a compelling, personal perspective, one which I am tempted to say contains much autobiographical material. Whether the latter judgment is in error or not, "Space and Place" asks how a person, "who is animal, fantasist, and computer combined, experiences and understands the world." A key introductory passage establishes Tuan's purpose: "to understand the ways in which people attach meaning to and organize space and place." Tuan goes beyond the two explanatory factors automatically invoked and claims that the cultural approach overlooks shared traits that transcend cultural particularities. Culture is inescapable; its importance is reflected in every chapter. The second factor, our animal heritage, is similarly taken as axiomatic. In stressing that the book is not a catalog of how culture affects space and place, Tuan supersedes his work "Topophilia," which confronts us with innumerable examples of the impact of culture on. . . . And it is never clear what follows the "on."

In reaching beyond culture, "Space and Place" provides meaning to that often-used but ill-appreciated label, man-environment relations. The bonds between man and environment emerge in the continuous search for an understanding of place and space. Place is pause, a stable focus of personal values, a calm center of security and attachment. Space is movement, openness, freedom, and threat. We require space and place. Our lives, thoughts, and behavior reflect dialectical movements between these poles for organizing experience. This first theme is supported by two others.

Tuan sees man's body as the measure, as the basis for constructing a sense of space and place. The dimensions and asymmetries of the body provide a focal yardstick, and the biological facts of development and learning guide its use. The third theme stresses modes of experience. Space and place are known through the interweaving of sensation, feeling, and concept. Experience can be direct and intimate, indirect and mediated, but our world is a subtle and sensuous product of all experience.

Overarching and unifying these themes is Tuan's use of a humanistic philosophy to treat the question: "What is the nature of experience and of the experiential perspective?" Tuan systematizes humanistic insights not in a theoretical mode but by the use of "conceptual frames." These frames form the twelve chapters, encompassing issues such as myth, time, architecture, childhood, and crowding. Chapters follow a simple but effective logic: What do

we know about. . . ? But to know is not restricted to the analytical knowledge of theory and the empirical method. It unites experiences of everyday living, of anecdote and literature, and of introspection and speculation. Tuan is a master at conveying such eclectic material, and his mastery is best appreciated in contrast to the Tuan that we saw in "Topophilia."

"Space and Place" is the quintessential Tuan. Short, crisp sentences reflect a spartan writing style. The flow is driven by the rhythmic cadence of simple questions and by the use of such devices as "consider the. . .," "take. . .," and "here is. . . ." Tuan's sympathetic command of words generates etymological comments. Greek, Latin, German, and other languages provide insights into common spatial expressions. The search for meaning forces us to reflect upon our experience, to realize that we can articulate seemingly inchoate feelings. One wishes for the opportunity to talk with Yi-Fu about his ideas. My use of the first name measures his ability to generate a sense of what I can only describe as a "Socratic monologue" with the reader. You are invited to think and feel and share as you read.

Overall, the style is successful, although "Space and Place" suffers from a weak ending. The Epilogue is in direct contrast to the thoughtful material preceding it. We are offered a curiously belated, awkward attempt to drag in environmental design via clichéd questions that are "important." This does not ring true to the tone of the book. It does little to advance Tuan's goal, expressed in the closing words: "to increase the burden of human awareness." Reading this book by Tuan is not a burden, and "Space and Place" most certainly enriches our awareness of the experience of space.—ROGER M. DOWNS

ABSTRACTS OF ARTICLES

GEOGRAPHICAL REVIEW

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Continuity and Change in Historic Cities: Bath, Chester, and Norwich

LARRY R. FORD

Change is taking place in the historic cities of Bath, Chester, and Norwich, but the type, rate, and impact of change varies with different local "change management" planning techniques and with the differing character of the places themselves. Although England has national laws that authorize the creation and administration of conservation areas, local governments have leeway in deciding what should be conserved. This flexibility is limited, however, by intrinsic differences in the functional organization, architectural image, land parcel heritage, and scale of individual cities. Bath has proved amenable to renovation of housing, but massive commercial change there has been quite difficult. In Chester the opposite is true. Norwich, because of its initial organization, later history, and current planning, accepts change relatively easily. It is important that we learn from all three so that we can better plan cities which accept change while protecting a sense of place.

Slow Growth: A New Epoch of American Metropolitan Evolution

PHILLIP D. PHILLIPS and STANLEY D. BRUNN

Since 1970 the American metropolitan system has entered an epoch of slower population growth as a result of significant technological and social changes. Increased acceptance of birth control devices and abortion have lowered natural population increase in the system while communications improvements and the growth of nonmetropolitan resort and retirement communities have produced net migration out of metropolitan areas. Public perceptions have also favored a "rural renaissance" and the growth of the "Sun Belt" at the expense of the Manufacturing Belt. A near-zero-sum game of metropolitan growth has heightened inter-regional competition for jobs and population. Prolonged slow growth will have serious impacts on age and employment structures, possibly producing a conservative "risk-avoidance" outlook within an aging infrastructure. The metropolitan system faces an uncertain prospect because many post-1970 trends, especially extensive exurban development and higher fuel costs, are not compatible over long periods of time.

Perceptual Regions in Texas

TERRY G. JORDAN

Perceptual regions, composites of the mental maps of the resident population, may be regarded as part of popular or folk culture. Various types of perceptual regions in Texas are detected and charted from a study based on questionnaire responses from Texans in all parts of the state. Twenty-nine major regions are revealed, and eight others are defined in compass terms. Physical environment, culture, history, political borders, and local boosterism influence regional perception. Some regions are waning and retreating in the popular mind, while others exhibit growth. A limited assessment of positive and negative regional perceptions is made. The study of perceptual regions has great potential value for cultural and economic geographers.

The Emergence of a New "Downtown"

THOMAS J. BAERWALD

The suburban freeway corridor has emerged since World War II as a new "downtown" in large American metropolises. Analysis of the Minneapolis-St. Paul SFC indicated a four-stage development related to the times at which specific types of land use entered the corridor and to the vacant land available at those times. Residential and commercial uses occupied central corridor locations during the early stages. Office buildings and motor hotels were constructed later as speculative ventures. Industry developed throughout the corridor's history and was dispersed. The future of the corridor is related to the metropolitan circulation system and the ease with which the corridor may be redeveloped.

Places for Mysteries

DOUGLAS R. McMANIS

Setting has traditionally been an important component of a story in British mystery fiction. The geographical elements of the setting, inevitably drawn from the real world, were used in one of several ways in plots. A place could be a simple, stagelike location, identified only by place-name, for the action of a story. Geographical elements could be used throughout a story because they were essential to the occurrence and solution of a mystery or because they were part of the diversionary features introduced to make a plot more baffling to readers. Examples of these uses of geography may be found in the numerous writings of Dame Agatha Christie and in those of the less prolific Dorothy L. Sayers. Their works contain a variety of literary landscapes and illustrate the role of personal writing style in presentation of geographical items. Christie treated them in her terse, capsulated style. Sayers was more expansive, and consequently geography in her novels was offered on a verbal palette that at its best suggested regional as well as mystery fiction.

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CHANGING CONCENTRATIONS OF OLDER AMERICANS

THOMAS O. GRAFF and ROBERT F. WISEMAN

OLDER persons are one of the largest and fastest growing minorities in the United States.¹ During the twentieth century the number of elderly Americans has increased sevenfold, from slightly more than 3.1 million in 1900 to more than 22 million in 1975. In 1900 only 4.1 percent of the United States population was aged 65 or older; by 1975 the percentage had risen to 10.5.² These absolute and relative increases in the size of the elderly cohort derive from an increase in life expectancy from 47 to more than 70 years and from a decrease in the national birthrate from 32 to 17 per thousand. If birth and death rates remain at their present levels, by the end of this century more than 30 million Americans, or about 12 percent of the population, will be classified as elderly.³

The economic importance of the elderly group has also increased dramatically. Although many older Americans live on subpoverty-level incomes, the advent of retirement plans, private pension funds, deferred profit-sharing programs, and increases in Social Security payments over the past several decades help many others to enjoy a relatively affluent old age. For example, between 1950 and 1970 average Social Security payments per person increased nearly 40 percent. Over the same period the number of persons receiving benefits from private pensions increased more than tenfold, and total payments more than twentyfold.⁴ As a result, median income for older people rose from \$847 in 1950 to \$2,042 in 1970,⁵ and projections indicate that rapid income growth will continue. Among other things this rising affluence has contributed to higher residential mobility rates. Although elderly persons as a group are generally thought to be highly rooted, their mobility rates have been increasing

¹ Because of Social Security laws, 65 has become the accepted retirement age in the United States. For the purposes of this paper, the terms "aged," "older," and "elderly" refer to persons 65 years or older. Large numbers of, but not all, "retired" persons are presumed to be age 65 and older.

² "Demographic Aspects of Aging in the United States," *Current Population Repts., Special Studies*, U.S. Bur. of the Census, Washington, D.C., May, 1976, p. 8. The Bureau of the Census projects that between 10.7 and 12.5 percent of the United States population will be aged 65 years or older by the end of this century. Continued declines in national birth and death rates, such as are now occurring, will increase the proportion of elderly people.

³ *Ibid.*

⁴ *Statistical Abstract of the United States*, 1976, p. 305.

⁵ Although inflation reduces the effect of these improvements, the rise in property values more than compensates for such losses for homeowners and for people with real estate investments.

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steadily. With 28 percent of the population aged 60 and over reporting a change of residence between 1965 and 1970, migration rates for this group are now more than half the national average.⁶ Coupled with the growing number of older persons, increased mobility has significantly altered the population structures of certain states or of entire regions. Transfer payments to retirees have become a major source of basic income in some areas of the United States. At the same time, some communities are beginning to experience the increased costs of social service associated with an aging population. As a group, older Americans are receiving increased attention from the general public, from academicians, and from public officials. The number and the scope of government programs designed to ameliorate problems of older persons have rapidly expanded;⁷ but the number of older Americans also continues to expand. As their residential mobility is further enhanced, the economic and social impact of the elderly will become even more important.

Despite the increasing importance of and the heightened concern for older Americans, surprisingly little study has been devoted to the most fundamental of questions—where are they? Most social scientists have focused instead on analyses of elderly migrants, only secondarily dealing with their distribution.⁸ A major exception is Donald O. Cowgill's 1965 examination of aging in the Midwest.⁹ His detailed examination of county-level data reveals vast differences in the percentages of older population throughout the region. Although geographical literature on aging is developing, the few investigations of elderly distributional patterns are confined to the intraurban scale.¹⁰ Analyses at such a level overlook broader national patterns; and migration studies exclude from consideration the large numbers of stable elderly. A basic description of the present spatial patterns of the elderly and an identification of the major processes producing them has yet to be completed.

The purpose of this study is to describe the spatial patterns of elderly concentrations in the United States in 1950 and in 1970, to examine changes in patterns over this time period, and to identify factors responsible for spatial and temporal patterns.

⁶ "Mobility for States and the Nation," 1970 *Census of Population, Subject Repts.*, U.S. Bur. of the Census, Washington, D.C., p. 2. Of the U.S. population aged 5 or over, 47 percent changed addresses between 1965 and 1970.

⁷ E. J. Cantilli and J. L. Schmelzer, eds.: *Transportation and Aging: Selected Issues* (Report from the 1970 White House Conference on Aging, U.S. Govt. Printing Office, Washington, D.C., 1970).

⁸ Studies by Goldscheider, by Lenzer, and by Bultena and Wood find that elderly migrants have higher socioeconomic status than nonmigrant elderly, that most elderly migrants are drawn from large population centers in the Midwest, and that many move to Florida, California, Arizona, and Texas (Calvin Goldscheider: *Differential Residential Mobility of the Older Population*, *Journ. Gerontol.*, Vol. 21, 1966, pp. 103-108; Anthony Lenzer: *Mobility Patterns Among the Aged, 1955-1960*, *Gerontologist*, Vol. 5, 1965, pp. 12-15; and Gordon Bultena and Vivian Wood: *Normative Attitudes Toward the Aged Role Among Migrant and Nonmigrant Retirees*, *Gerontologist*, Vol. 9, 1969, pp. 204-208). Barsby and Cox have investigated interstate migration of the elderly and confirm that most southern states are experiencing rapid increases in elderly populations (Steve L. Barsby and Dennis R. Cox: *Interstate Migration of the Elderly* [D.C. Heath and Company, Lexington, Mass., 1975]).

⁹ Donald O. Cowgill: *The Demography of Aging in the Midwest*, in *Older People and Their Social World* (edited by A. Rose and W. Peterson; F. A. Davis, Philadelphia, 1965), pp. 275-310.

¹⁰ See, for example, Stephen Golant: *The Residential Location and Spatial Behavior of the Elderly: A Canadian Example*, *University of Chicago, Dept. of Geography, Research Paper No. 143*, Chicago, 1972; Frederick P. Stutz: *Adjustment and Mobility of Elderly Poor Amid Downtown Renewal*, *Geogr. Rev.*, Vol. 66, 1976, pp. 391-400; Duane F. Marble, Parry Hanson, and Susan Hanson: *Intraurban Mobility Patterns of Elderly Households: A Swedish Example*, in *Proceedings of the Transportation Research Forum: First Conference on Transportation, Bruges, Belgium* (Richard B. Cross Co., Oxford, Ind., 1973), pp. 655-666; Robert Wiseman and Mark Virden: *Spatial and Social Dimensions of Intraurban Elderly Migration*, *Econ. Geogr.*, Vol. 53, 1977, pp. 1-13; and John Iltton and Bruce Smith: *Intraurban Residential Location of the Elderly*, *Journ. Geogr.*, Vol. 73, 1974, pp. 23-33.

Examination of such dynamics will improve our understanding of the current distribution of older people and is essential to anticipating future spatial patterns.

LOCATIONAL PATTERNS OF THE ELDERLY

Census data at the state and county levels for the years 1950 and 1970 provide the data base for this examination of the distribution of elderly Americans. Data for these two periods are comparable, and the time span between censuses is sufficient to allow for the nearly complete replacement of the elderly cohort.¹¹ The base year, 1950, was selected to provide for the examination of only one generation of elderly people. In the period from 1950 to 1970 relatively few momentous events, such as major wars or depressions, affected demographic structures significantly. Maps derived from these data provide the basis of this study.¹²

In 1950, 8.1 percent of the United States population was classified as older. At the state level, New Hampshire had the highest proportion of elderly population in the nation, 10.8 percent (Table I), followed by Vermont, Iowa, Missouri, and Maine. Western and southern states showed relatively few older persons, with New Mexico having the lowest proportion, 4.9 percent. Other states with relatively few elderly included South Carolina, North Carolina, Arizona, and Utah.

Broad areas with high county concentrations of elderly are observed in New England, the Midwest, and the Eastern Great Plains (Figure 1). Peninsular Florida contains a concentration, although the statewide percentage is not particularly high. Counties in the Southeast and West, on the other hand, have small components of elderly. The great variability in the percentage of the older cohort in western states is probably due to the small total population in many of their counties.

Twenty years later the 1970 census classified 9.9 percent of the population as elderly, an increase of 1.8 percent. Florida had the highest proportion of elderly in the nation, 14.6 percent (Table I). Other states with high percentages of older persons included Iowa, Nebraska, Arkansas, and South Dakota. Excluding Alaska and Hawaii, Nevada had the lowest proportion of elderly in the nation, with 6.3 percent. Other states with low percentages of elderly included New Mexico, Utah, South Carolina, and Maryland.

At the county level, the elderly were concentrated in broad areas of non-metropolitan sections of the Great Plains and of the Midwest (Fig. 2). Peninsular Florida and counties in the northern Midwest and Appalachia also had concentrations of older persons. The West displays a complex pattern of counties with both high and low proportions of the elderly cohort. Although counties with low proportions are scattered throughout the country, clusters are discernible in the South and in the North Central states.

DEMOGRAPHIC PROCESSES PRODUCING CHANGE

Three basic demographic processes—fertility, mortality, and migration—are re-

¹¹ More recent county-level data from the Administration on Aging, U.S. Department of Health, Education, and Welfare are not utilized here because they are based on demographic estimates developed from the Census of Population of 1970.

¹² The Bureau of the Census has published choroplethic maps showing county percentages of persons aged 65 and over for 1960 and 1970. However, the class intervals do not display county percentages in relation to the national percentage. In this study the class intervals are constructed about the national percentage for each census. Alaska and Hawaii are not included in this study because both became states during the study period and both have exceedingly small numbers and percentages of elderly population.

sponsible for the age distribution of a population. Because of the decline in immigration to the United States, birth and death rates have assumed prime control of the demographic character of American society. Births increase the size of the younger population; deaths (since they occur principally in the older age groups) decrease the size of the older cohort. Net migration combines with birth and death rates on a regional scale to produce variations in population structures.

Migration is selective with respect to age. Demographers employ the "life-cycle" or "stages-in-life" concept to explain changes in residence.¹³ Abrupt changes in career patterns or family structure create the likelihood of a residential move. Changes of residence frequently occur upon graduation, career initiation, marriage, family expansion, promotion, or retirement. Within the major stages of life, career advancement most frequently engenders decisions for long-distance migration. Consequently, explanations of major population shifts traditionally have focused on differentials in the distribution of economic opportunities. Changing economic and demographic realities prompt a closer examination of the retirement stage of life. Presumably, retirees have concluded their years of employment and therefore place less emphasis on economic stimuli. Other factors, such as quality-of-life amenities, should therefore assume paramount importance to older Americans.

"Within the United States, nearly all of the ecological variation in percentages of the aged is due to selective patterns of migration."¹⁴ Two types of migration produce regional populations with increased concentrations of older persons, in-migration of older people and out-migration of younger persons. Areas possessing retirement amenities attract older persons, resulting in selective in-migration that produces a local concentration of elderly persons. Other regions lack the economic opportunities to retain their younger adults. Selective out-migration of younger adults also produces a regional concentration of older persons, those who have "aged-in-place."¹⁵

PROCESSES PRODUCING INCREASES

The somewhat modest 1.8 percent increase of the older cohort between 1950 and 1970 masks a dramatic spatial redistribution of the elderly. As a region the South (as defined by the census) experienced the greatest change, its percentage increasing from 6.9 in 1950 to 9.6 percent in 1970. Although there is some correspondence between the 1950 and the 1970 rankings of states by their proportion of elderly residents (Spearman $r = 0.67$), certain states manifest noteworthy shifts. In 1970, for example, Florida led the nation with highest proportion of elderly, but in 1950 it ranked only twenty-first (Table I). Other states that rose in rank include Arkansas, West Virginia, and South Dakota.

The spatial dimension of these shifting concentrations can be mapped by the changes that occurred between 1950 and 1970 in the proportions of elderly in county populations.¹⁶ Vast sections of nonmetropolitan areas in the Great Plains, the Gulf

¹³ Peter Rossi: *Why Families Move* (The Free Press, Glencoe, Ill., 1955); Gerald R. Leslie and Arthur H. Richardson: *Life Cycle Pattern and the Decision to Move, in Social Demography* (edited by T. R. Ford and G. F. DeJong: Prentice-Hall, Inc., Englewood Cliffs, N.J., 1970); William Ye and Maurice D. Van Arsdol, Jr.: *Residential Mobility, Age, and Life Cycle*, *Journ. Gerontol.*, Vol. 32, 1977, pp. 21-31.

¹⁴ Cowgill, *op. cit.* [see footnote 9 above], pp. 282.

¹⁵ The term "aging-in-place" denotes the process of cohort transition to increasing age and residential inertia.

¹⁶ Between 1950 and 1970 the proportion of the United States population classified as older increased 1.8 percent. In this analysis, an increase of 3.6 percent is considered notable.

TABLE 1—PERCENTAGE OF ELDERLY AND OF POPULATION CHANGE AMONG STATES, 1950 AND 1970

STATE	1970 % ELDERLY	1960-1970	1950 % ELDERLY	1940-1950	1950 RANK OF ELDERLY %
		% CHANGE IN ELDERLY POPULATION		% CHANGE IN ELDERLY POPULATION	
Florida	14.6	31.7	8.6	46.1	21
Iowa	12.4	2.5	10.4	3.3	3
Nebraska	12.4	5.2	9.8	.7	8
Arkansas	12.4	7.7	7.8	-2.0	29
South Dakota	12.1	-2.1	8.5	1.5	23
Missouri	12.0	8.3	10.3	4.5	4
Kansas	11.9	3.2	10.2	5.8	6
Oklahoma	11.7	9.9	8.7	-4.4	19
Maine	11.5	2.5	10.2	7.9	5
Massachusetts	11.2	10.5	10.0	8.7	7
West Virginia	11.2	-6.2	6.9	5.4	37
Rhode Island	11.0	10.5	8.9	11.0	13
Oregon	10.9	18.3	8.7	37.0	16
Pennsylvania	10.8	4.2	8.4	6.0	25
New York	10.8	8.7	8.5	10.0	22
Minnesota	10.8	11.4	9.0	6.8	10
North Dakota	10.7	-2.3	7.8	-3.5	30
Wisconsin	10.7	11.8	9.0	9.5	11
Vermont	10.7	14.1	10.5	5.2	2
New Hampshire	10.6	21.5	10.8	8.5	1
Kentucky	10.5	6.0	8.0	3.5	28
Mississippi	10.1	1.8	7.0	-0.2	35
Montana	9.9	2.9	8.6	5.6	20
Illinois	9.9	10.2	8.7	10.3	18
Tennessee	9.8	10.1	8.1	8.1	33
New Jersey	9.8	18.0	8.1	16.2	27
Connecticut	9.6	19.6	8.8	17.4	15
Idaho	9.5	6.9	7.4	12.1	31
Indiana	9.5	11.4	9.2	14.8	9
Alabama	9.5	5.4	6.5	8.1	41
Washington	9.5	19.6	8.9	37.0	14
Ohio	9.4	9.8	8.9	15.0	12
Washington, D.C.	9.4	-1.0	7.1	21.0	34
Arizona	9.1	36.1	5.9	50.1	40
Wyoming	9.1	0.7	6.3	15.9	44
California	9.1	27.1	8.5	53.3	24
Texas	8.9	16.9	6.7	20.2	39
Colorado	8.5	26.0	8.7	18.0	17
Michigan	8.5	13.5	7.2	21.2	32
Louisiana	8.5	11.9	6.6	13.5	40
North Carolina	8.2	11.6	5.5	13.7	47
Georgia	8.0	22.8	6.4	10.3	43
Delaware	8.0	16.4	8.3	19.4	26
Virginia	7.9	17.3	6.5	23.9	42
Maryland	7.7	26.5	7.0	28.6	36
South Carolina	7.4	8.7	5.4	11.4	48
Utah	7.3	18.9	6.2	25.2	45
New Mexico	7.0	6.9	4.9	28.1	49
Nevada	6.3	71.3	6.9	45.2	38

Coastal Plains, and Appalachia show major increases (Fig. 3). Peninsular Florida and the northern parts of Michigan, Wisconsin, and Minnesota, along with scattered groups of counties in the West, also had significant growth in their proportions of elderly.

Aging-in-place associated with the selective out-migration of younger cohorts appears to be the dominant factor accounting for most of the large increases in the county percentages of elderly persons between 1950 and 1970. This same combination is also responsible for most concentrations of elderly persons at the county level in both 1950 and 1970. In certain smaller geographical areas selective in-migration of

THE ELDERLY IN 1950

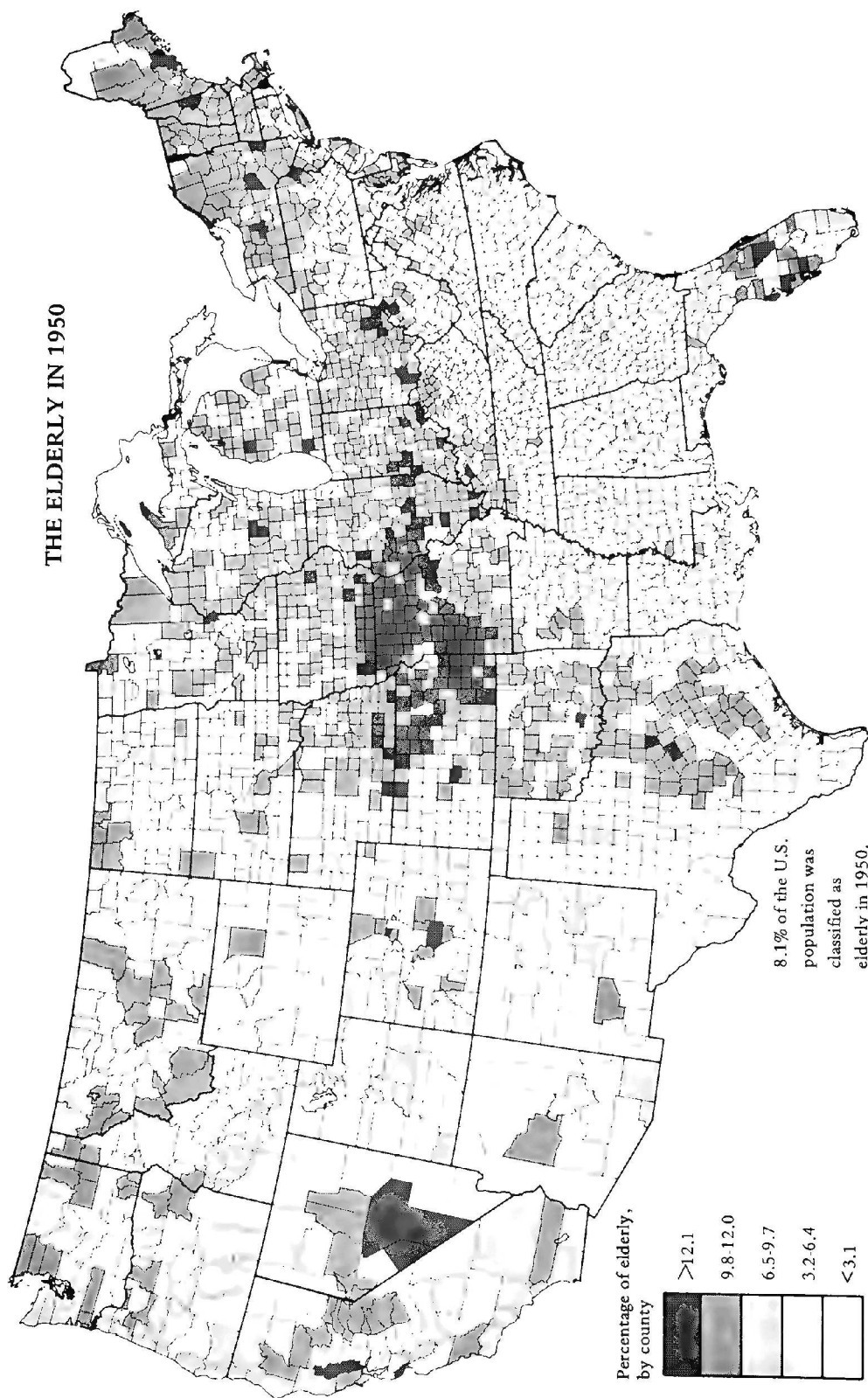


FIG. 1—County concentrations of persons aged 65 years or older, produced from 1950 census data.

THE ELDERLY IN 1970

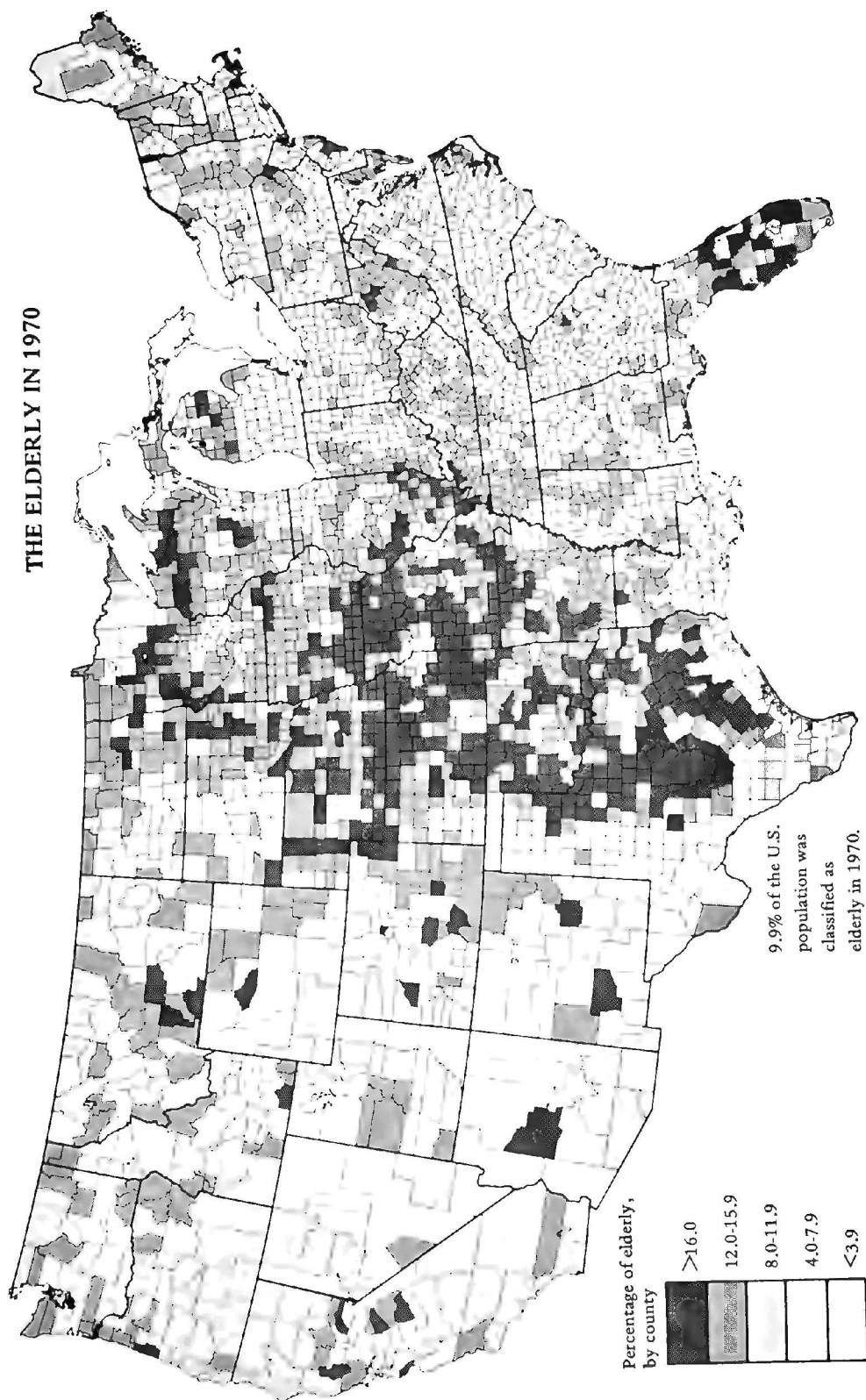


FIG. 2—County concentrations of persons aged 65 years or older, produced from 1970 census data.

older cohorts produces concentrations of elderly persons. The relative importance of each of these processes varies both spatially and temporally.

In 1950 and in 1970 vast sections of the nonmetropolitan Midwest and Great Plains had high percentages of older persons. The 1950 distribution also displayed high percentages of elderly in nonmetropolitan areas of New England. Aging-in-place in combination with out-migration of younger cohorts appears to be the dominant factor producing these concentrations. For decades, the cutover timber areas of New England and the highly mechanized agriculture of the central United States had employed declining numbers of workers. Younger persons left these areas in a massive rural-urban migration which produced a population structure that had aged-in-place.¹⁷ Because of these demographic shifts, areas experiencing population declines or minimal increases frequently contained high proportions of older people. Correlations of statewide percentages of older persons with statewide percentages of population declines during the previous decade produced significant results (Spearman $r_{1950} = 0.36$ and Spearman $r_{1970} = 0.49$). Similarly, these same factors are now altering population structures in the impoverished rural areas of the South and of Appalachia. Although these areas have yet to develop major concentrations of elderly people, they did record major increases in the older percentages between 1950 and 1970.

The uneven increases in the proportion of elderly residing in rural areas that experienced net out-migration suggest that the aging-in-place process does not affect all regions uniformly. In both 1950 and 1970 rural areas of the Midwest and of the Great Plains had high concentrations of elderly, but the 1970 concentration was noticeably displaced to the west and south. During this period rapid increases were recorded throughout the Great Plains, but not extensively in the Midwest. The aging-in-place process evidently operates on demographic structures developed during earlier periods. Rapid increase in the percentage of elderly appears to lag behind the period of maximum rural settlement by several decades. The westward shift of the area of great concentration mirrors the earlier settlement sequence, with aging-in-place intensified by the out-migration of younger cohorts during this as well as the earlier period.

Aging-in-place and out-migration produce variations in local population structure as well. Selective migration of younger cohorts from major metropolitan centers leaves an older, aging-in-place population in central cities. Counties of major Standard Metropolitan Statistical Areas (SMSAs) such as New York City and Detroit already have experienced notable increases in older population percentages (Fig. 3).

Through the process of elderly in-migration, the older cohort is becoming an active participant in the development of certain areas reporting large increases. In peninsular Florida the low concentration of older persons of 1950 had grown to the highest

¹⁷ Because of these selective migrations most areas that have experienced stable or declining populations have relatively high proportions of elderly persons residing in rural areas and low proportions in urban areas. For example, the 1970 census reported that in Kansas 14.3 percent of the rural population and 10.6 percent of urban population were aged 65 and older. Similarly, states such as Illinois, Iowa, Kentucky, Nebraska, and the Dakotas had higher proportions of older persons residing in rural areas. Conversely, many states experiencing large in-migrations of persons seeking environmental amenities have high percentages of older persons residing in urban areas. For example, in Florida 14.9 percent of the urban population and 13.1 percent of the rural population were elderly. Similarly, Arizona, Connecticut, and California had higher percentages of elderly in urban rather than rural areas. These inverse processes have produced a national population with similar percentages of elderly residing in urban and rural areas. In 1970, 9.8 percent of the United States urban population and 10.1 percent of the rural population were classified as aged.

in the nation by 1970. Although the percentage of elderly in Florida in 1970 is high at 14.6 percent, several peninsular counties report more than 25 percent of their population as aged 65 or over. Charlotte County, immediately north of Fort Myers, leads the nation with 35 percent of its population classed as older. Scattered counties in southern and southwestern states also had high percentages of older persons in 1970, though many of these areas experienced rapid population growth as large numbers of Americans of all ages migrated to the Sun Belt.

The effect of the migration of older Americans to retirement areas was much more intense and widespread in 1970 than it was in 1950. Migration upon retirement is a recent phenomenon for all but the wealthiest Americans.¹⁶ By the end of the Great Depression, the financial resources of most Americans were exhausted. Despite the rise in employment during the 1940's, it seems unlikely that most older Americans could have acquired the resources necessary for a satisfactory retirement by 1950. By 1970, however, the financial circumstances of many older Americans had improved dramatically. The economic advance in the post-World War II period has provided rising incomes, widespread homeownership, and increased pension benefits. The rise in mobility, particularly expanded vacation travel, has produced greater awareness of amenity locations. These and other factors have probably reinforced concentrations of elderly in traditional retirement areas such as Florida and contributed to the emergence of newer areas such as these in northern Michigan, in the Pacific Northwest, and in the Ozarks.

Some famous havens for the retirement such as Arizona, however, have a surprisingly small proportion of older people. For example, the total population of Maricopa County—the famed location of Phoenix and Sun City—nearly tripled between 1950 and 1970, but the older cohort increased only from 6.9 to 9.1 percent. The percentage of elderly in Maricopa County remains below the national average of 9.9. Obviously, the recent influx to the Phoenix area includes more than older persons.

PROCESSES PRODUCING DECLINES

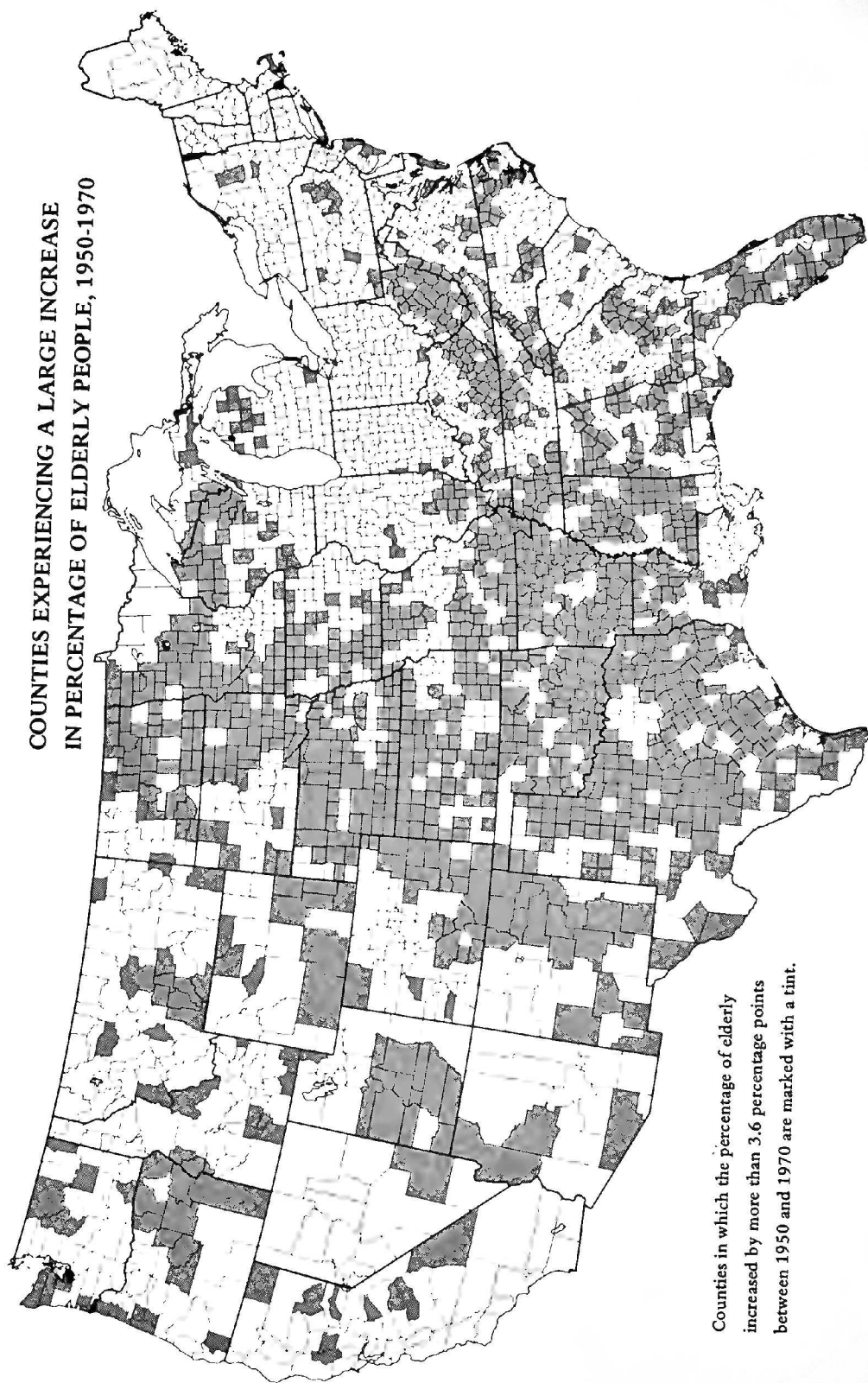
Although the percentage of older people increased between 1950 and 1970 for the nation, many areas recorded declines. Four states—Colorado, Nevada, Delaware, and New Hampshire—reported notable statewide declines. At the county level large areas that experienced declines are found in the northeastern and western states (Fig. 4). These declines appear to be associated with in-migration of younger cohorts and with high death rates of the older cohort.

Most declines result from the in-migration of younger cohorts. Many of the broad areas, especially in western states, have rapidly expanding economies and populations. Isolated counties reporting declines have economies based on activities that attract the younger cohort—large universities, military bases, or government centers, for example. The rapid influx of opportunity-seeking younger cohorts has inundated the small, aging-in-place, long-term population and has produced a more youthful county age structure. A similar process can be observed in the suburban portions of metropolitan areas, such as Washington, D.C., New York City, Chicago, and Portland, Oregon, as younger cohorts migrate to the suburbs for residential amenities.

In the Northeast, especially Ohio, northern Indiana, southern Michigan, and

¹⁶ Frank A. Troutman: *Retirees as Development Opportunity in the South* (unpublished Ph.D. dissertation, College of Business Administration, Univ. of Arkansas, Fayetteville, 1967).

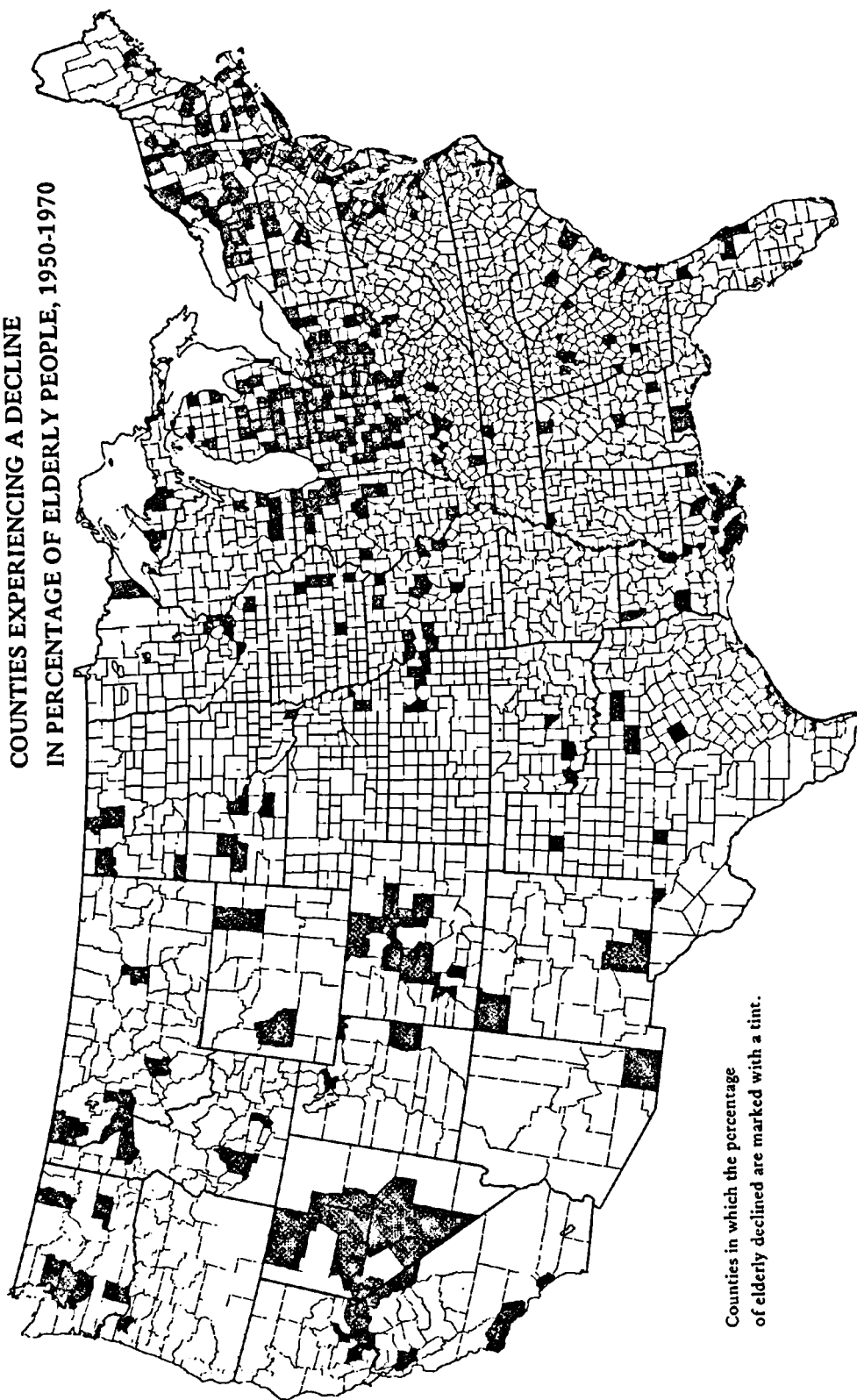
COUNTIES EXPERIENCING A LARGE INCREASE
IN PERCENTAGE OF ELDERLY PEOPLE, 1950-1970



Counties in which the percentage of elderly increased by more than 3.6 percentage points between 1950 and 1970 are marked with a tint.

FIG. 3—Increasing concentrations of the elderly, calculated by the authors from census data.

COUNTIES EXPERIENCING A DECLINE
IN PERCENTAGE OF ELDERLY PEOPLE, 1950-1970



Counties in which the percentage
of elderly declined are marked with a tint.

FIG. 4.—Decreasing concentrations of the elderly, calculated by the authors from census data.

northern New England, large groups of counties experienced a decline in the concentrations of older people, owing partially to migration of younger cohorts to suburban areas near major cities. In many counties, however, the process of dying-in-place of older the cohort appears to be the major factor. In 1950, these areas had the greatest concentrations of elderly in the nation. Most of the rural population derived from earlier periods of in-migration. This population, which was aging-in-place in the 1950's, was dying-in-place by the 1960's, and much of the older cohort had disappeared by 1970.¹⁹ Just as aging-in-place predictably lags behind maximum rural settlement densities, dying-in-place inevitably follows aging-in-place.

THE FUTURE

Five major processes have been identified as producing regional disparities in age structure: aging-in-place, dying-in-place, in-migration of elderly, and both in-migration and out-migration of younger persons. These processes can logically be expected to continue to affect the population structure of the nation, although their relative importance appears to be changing. Until recently, aging-in-place, coupled with out-migration of younger cohorts, has been the major factor producing concentrations of elderly, but in the future aging-in-place should become the dominant process. The out-migration of younger persons, particularly the rural-urban and the South-North streams, has already subsided. As noted earlier, the nation's major concentration of elderly in the Midwest and Great Plains is associated with the process of aging-in-place. The westward shift of this pattern between 1950 and 1970 mirrored earlier settlement patterns and lagged behind the period of maximum agrarian population. This westward shift can be expected to continue into the 1980's, but its spatial extent will be limited at the edge of the Rocky Mountains. Because of discontinuities in the western settlement pattern, a more dispersed distribution of aging-in-place will later evolve.

Before the end of this century, the broad concentration of elderly in the Great Plains will disappear—in the same wavelike manner in which it moved from the Midwest—as a result of dying-in-place. This process was observed in New England and the eastern Midwest for the study period. It can also be expected to reduce the evolving elderly concentrations in Appalachia and the rural South. Owing to aging-in-place, major concentrations of elderly people are rapidly emerging in central cities, particularly in older metropolitan areas.²⁰ Just as out-migration of younger cohorts intensified the evolution of the rural concentrations of elderly, suburbanization and

¹⁹ Conceivably, two processes, either out-migration of the older cohort or death of the older cohort, could reduce the size of this group. In 1960 the highest death rates in the nation for the 65-and-older cohort were reported in the New England, Middle Atlantic, and East North Central states. In addition, these states all reported a net out-migration during the 1950-1960 period for the 65-and-older cohort. However, in this time period, deaths accounted for more than 90 percent of the reduction of the size of the older cohort in each of these areas. Therefore, death is the dominant process reducing the size of the older cohort. See "The Vital Statistics of the United States, 1961, Vol. II, Mortality" (U.S. Public Health Service, Washington D.C., 1964); Gladys K. Bowles: Net Migration of the Population, 1950-1960, by Age, Sex, and Color, Vol II, Analytic Groupings of Counties (U.S. Dept. of Agriculture, Econ. Research Service, Washington, D.C., 1973).

²⁰ This conclusion apparently contradicts Kennedy and DeJong, who found, in their study of central cities of ten SMSAs, that elderly neighborhoods are developing primarily in newer cities. Their findings are based on analysis of census tract data. Ours, based on county data, show that the entire central city county of older SMSAs is rapidly aging. See John M. Kennedy and Gordon F. DeJong: *Aged in Cities: Residential Segregation in 10 USA Central Cities*, *Journ. Gerontol.*, Vol. 32, 1977, pp. 97-108.

exurbanization are producing ghettos of the aged. The same prognosis can be extended to older suburban developments and to newer urban centers. Although some elderly people can be expected to migrate from these areas, the high degree of residential inertia that still characterizes the older cohort ensures the continued dominance of the aging-in-place process.

Migration of older Americans for retirement amenities is becoming a movement of major magnitude. Although the rate of elderly interstate migration is low, 3.8 percent between 1965 and 1970, the spatial concentration of these movements in just a few retirement areas produces a heavy impact. It is also likely that the rate of such movements will increase in the near future. Greater affluence and mobility have produced a population increasingly aware of attractions available in many sections of the country. Growing numbers of older persons are deciding to retire to amenity areas when employment is no longer a determinant of residential location. Further gains in both the number and the incomes of older persons will greatly increase the significance of this movement in the near future.

Counties that presently attract large numbers of retired Americans will be focal points of major concentrations in the future. Ideally, those counties that are classified as "Specialized Amenity Retirement Areas" should have experienced such massive influx of retirees from outside the area that in-migration owing to other causes appears relatively minor in nature. A county must, therefore, have at least 15 percent of its 1970 population classified as older, have experienced at least a 5.4 percent increase between 1950 and 1970 in its percentage of older persons, and have had a net in-migration between 1960 and 1970. The requirement that 15 percent of the 1970 population be classified as older limits amenity retirement areas to counties with more than one and one-half times the national percentage of elderly. The 5.4 percent increase restricts retirement areas to counties experiencing at least three times the national increase of older persons. Since large-scale migration upon retirement to amenity areas is a recent phenomenon, these areas should have experienced a marked increase in their older component. The net in-migration requirement excludes those areas which have high percentages owing to the aging-in-place process.

Employing these three criteria, 94 counties in 17 states can be termed retirement areas (Fig. 5). Three southern states, Florida, Texas, and Arkansas, contain more than half of these counties. The preponderance of retirement locations in the South reinforces the observation that older persons desire warm winters, but the distribution of specialized amenity retirement areas in the eastern and the midwestern sections of the country suggests that vacation patterns and recreational attractions are also factors in the development of major retirement communities.²¹ Water-based recreational opportunities appear to be a major attraction for retirees. Beaches, lakes, reservoirs, and major fishing streams are popular recreational retreats, and many elderly persons move to vacation homes they have acquired in anticipation of retirement. Vacation areas in the Rockies and in New England, however, do not appear to be developing concentrations of retirees, but to suggest that cold winters prohibit the development of specialized amenity areas is at variance with observed development in such areas as northern Michigan, Wisconsin, and Minnesota.

Metropolitan centers are not major retirement areas. Only one city of more than

²¹ A recent study undertaken in Arkansas confirms this observation (Fred M. Shelley and Curtis C. Roseman: *Migration Patterns Leading to Population Change in the Metropolitan South, Growth and Change*, in press).

SPECIALIZED AMENITY RETIREMENT AREAS

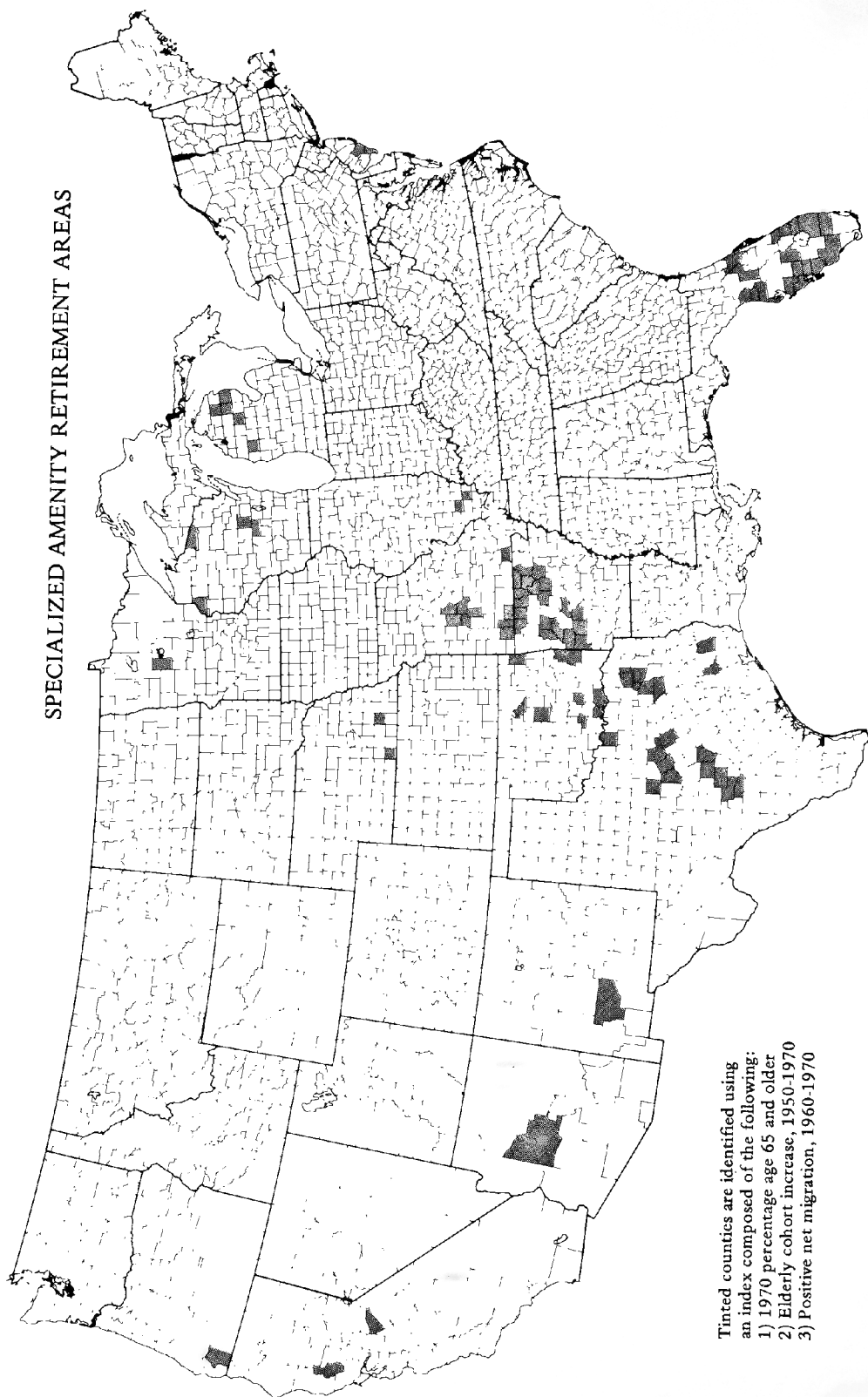


FIG. 5—Counties experiencing dramatic increased concentrations of elderly persons, calculated by authors from census data.

100,000 inhabitants—St. Petersburg, Florida—and only two SMSA counties outside of Florida meet our criteria for designation as amenity areas. Retirees prefer non-metropolitan locations. In fact the older cohort is the most rapidly growing segment of the emerging metropolitan-nonmetropolitan migration pattern.²² In part, this preference for the rural way of life could stem from dislike of metropolitan life-styles, fear of big-city crime, avoidance of high metropolitan taxes, or a favorable perception of small-town life. The present concentration of older Americans in amenity locations appears to be the start of a significant redistribution of elderly people. Many of the early migrants that provided the impetus for metropolitan growth are now approaching retirement age. Already several central cities have experienced dramatic increases in their proportions of elderly persons. Progressive metropolitan decay, growing concern with quality-of-life considerations, and increases in retirement incomes combine to make elderly migration from metropolitan areas a more attractive and feasible option.

Even though much of the anticipated increase in elderly migration can be expected to terminate in these and amenity retirement areas, the more widely dispersed pattern of elderly migration suggests the development of local retirement communities (Fig. 5). Certainly the growth of elderly concentrations in far-flung areas of northern Michigan, northern Wisconsin, southern Nebraska, and southern Illinois do not result from long-distance migrations. Apparently, elderly migrants are relocating from large metropolitan centers to nearby vacation retreats. This relatively short-distance migration might result from spatial limitations of former vacation patterns, from advertising campaigns by real estate agencies, or from a desire to maintain social and kinship ties in the former community. The recent proliferation of "retirement housing complexes" and modest-sized "retirement communities" in suburban environs of metropolitan centers reflects the increasing importance of short-distance migration.

In summary, this consideration of future concentrations of elderly people highlights the dynamic nature of the spatial distribution of older Americans. It also suggests the changing importance of the processes that produce concentrations of older people. Aging-in-place and attendant dying-in-place have been and will continue to be the predominant processes. Their spatial impacts, however, are changing from the regional to a more local scale. The influence of younger cohort migrations on elderly concentrations appears to be waning, but the impact of age-specific suburbanization is still producing concentrations of elderly people in central cities.

The essentially passive role of the older cohort in producing elderly concentrations appears to be changing as elderly migration involves more people. During the period from 1950 and 1976 mobility rates of the elderly have more than doubled, from 2.6 to 5.6 percent.²³ Instead of quietly aging-in-place in areas of limited attractiveness, older Americans are in the vanguard of migrants who are relocating to some of the most desirable areas in the nation.

²² Jack Tucker: Changing Patterns of Migration Between Metropolitan and Nonmetropolitan Areas in the United States: Recent Evidence, *Demography*, Vol. 13, 1976, pp. 435-439, reference on p. 439.

²³ "Geographical Mobility: March 1975 to March 1976," *Current Population Repts., Population Characteristics*, U.S. Bur. of the Census, Washington, D.C., p. 12.

CEDAR AND MAHOGANY LOGGING IN EASTERN PERU*

STUART WHITE

IN SCATTERED areas of the Amazon Basin, removed from concentrations of activity along major rivers, small parties of natives and mestizos are extracting valuable timbers. Work is done without the assistance of power machines or animals and without direct financial support from corporate or governmental sources. Wood production per enterprise is generally low because numerous inconveniences, including environmental hazards and a prejudicial system of financing, bear heavily upon activities. My purposes in examining this form of tropical logging are to provide a record of a rudimentary human industry that has largely escaped the detailed attention of geographers and foresters and to determine the nature and permanence of the disturbance caused by such logging.

In this study a frontier area of Spanish cedar (*Cedrela odorata*) and mahogany (*Swietenia macrophylla*) logging along the lower Urubamba River in eastern Peru will be considered (Fig. 1). The natural vegetation of the region, almost entirely intact, is seasonal rain forest with an uneven but relatively high canopy. The tallest emergents reach 40 meters in height and 2 to 2.5 meters in diameter. At ground level the aspect is generally open. The intermediate and upper levels of the forest are laced with large vines and lianas, and tree trunks sometimes carry extravagant loads of epiphytes. Although characteristic associations of a few species are often noted along riverbanks and in swampy areas, plant composition is generally mixed. Climax associations on the Urubamba may consist of as many as a hundred species of large trees.¹ The implications of this extreme heterogeneity for the conduct of logging operations will be considered more fully below.

The climate is subhumid tropical, with a yearly average temperature of 26°C. Rains extend from October to April or May, reaching their greatest intensity in December and January. They are followed by a dry season of four or five months, which becomes severe only in July and August. Annual precipitation totals are not available, but they probably range between 1,500 and 2,200 millimeters.²

The terrain directly adjacent to the Urubamba is flat for widths of various miles downstream and narrows upstream to mere sandbars in the Pongo de Mainique, a deep gorge that separates the Andean foothills from the Amazon Basin. Farther removed from the floodplain are low but highly dissected hills. Along the Urubamba tributaries, particularly in their upper reaches, broken terrain borders the stream directly, forming massive rock and clay cliffs. The elevation of the Urubamba in the study area ranges from 300 meters above sea level at Sepahua to approximately 500 meters at the Yavero River. Slight, localized uplift still occurs, accounting for the active stream downcutting and dissected landscape that covers much of the region.

* Fieldwork for this study was undertaken in Peru during the summers of 1973 and 1974. I wish to thank Antonio Dávila, Narciso Basagoitia, Thomas R. Vale, and William M. Denevan for their assistance.

¹ F. Bruce Lamb: Mahogany of Tropical America: Its Ecology and Management (Univ. of Michigan Press, Ann Arbor, 1966), p. 180.

² "Estudio del potencial de los recursos naturales de la zona del río Camisea" (Oficina Nacional de Evaluación de Recursos Naturales, Lima, 1967).

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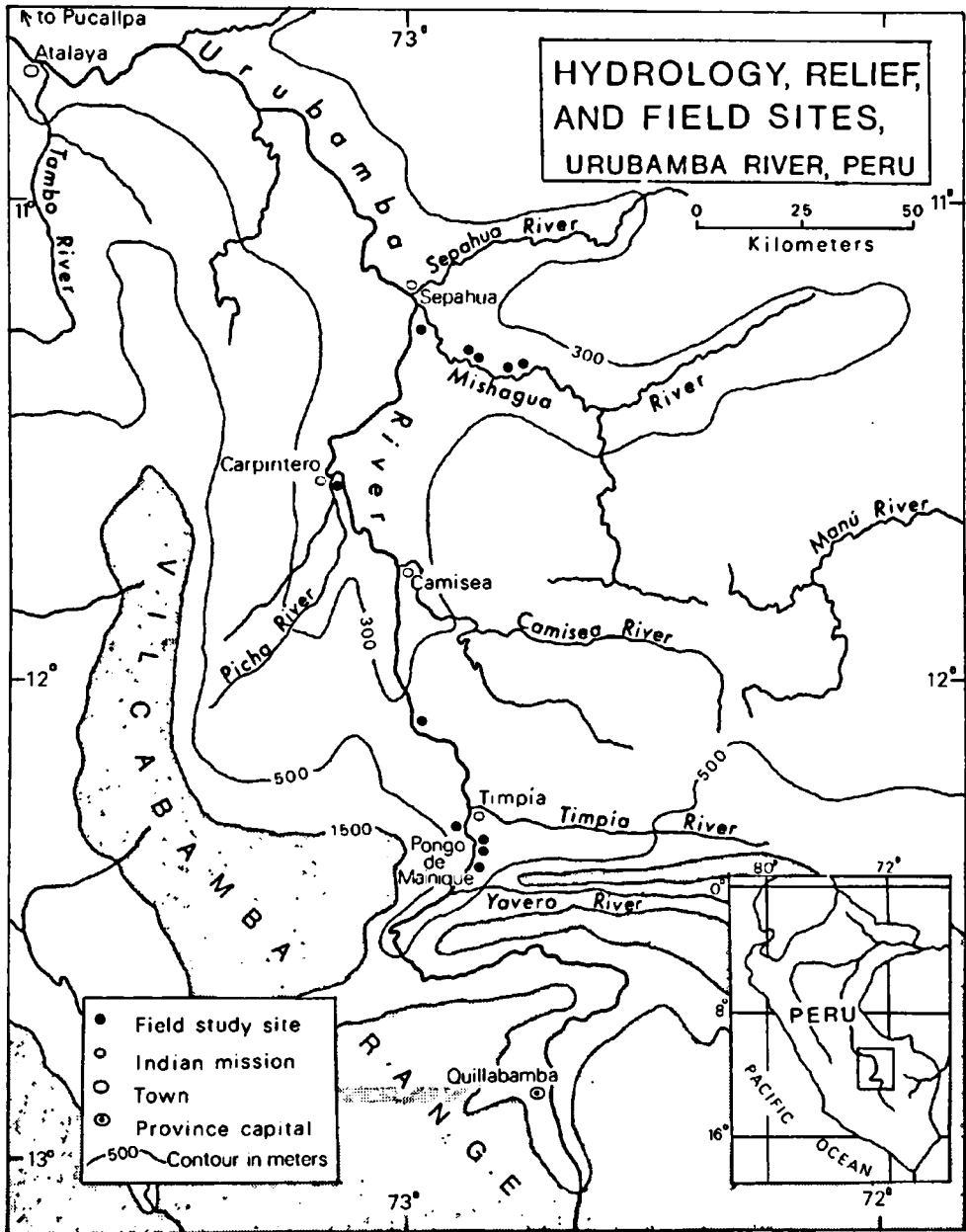


FIG. 1.—Hydrology, relief, and field study sites. The sites refer to logging and agricultural clearings (active and abandoned) that were visited during the two field periods.

THE PRIMAL STATE OF ENTREPRENEURIAL LOGGING

Selective logging operations as practiced in the remote regions of the Amazon Basin are largely ignored by the international financial community, and often by the domestic one as well. Though generated by external market prices they are sustained

by local moneys, entrepreneurs, equipment, and labor. They may be contrasted with corporate or governmental logging such as practiced in former European colonies in Africa and Central America, and with recent Japanese investment in a small number of Southeast Asian countries.³ These corporate enterprises operate independently of the local milieu,⁴ providing their own food, housing, log-moving equipment, and labor force, and they involve the investment of large sums of money and the extraction of large volumes of wood.

Entrepreneurial logging is characterized, in contrast, by a smaller scale, by rudimentary techniques, and by a labor force composed of the native inhabitants but controlled by mestizos.⁵ Principally because of the high cost of transport of wood from eastern Peru to Lima, cedar and mahogany do not enter the international market in large volumes,⁶ nor do they constitute the major portion of wood consumed in Peru. There appears to be little direct investment by government or corporations in regions such as the Urubamba, as there is with forests more accessible to local markets or sea transport or with those that contain more or less pure stands of a valuable species.⁷

Instead, investment occurs as a chain of *ad hoc* loans from capitalists in Lima to lumber company owners, who then loan to regional patrons, or *patrones fuertes*, with the condition that repayment be made in the form of logs delivered to their sawmills. The regional patrons will then invest in a number of local patrons, again with a contract to repay the debt incurred with timber. In each case the contracted price of delivery is much below the market price, a condition to which the borrower must accede.⁸

Although the major portion of his profit is derived in this way, the lender accrues

³ See, for example, Russell C. Stadelman: *Forests of Southeast Asia* (published by the author, Memphis, Tenn., 1966); L. E. Eeckhout: *L'exploitation forestière au Congo belge* (Services de l'agriculture du ministère des colonies et du gouvernement général du Congo belge, Bruxelles, 1953); Kenji Takeuchi: *Tropical Hardwood Trade in the Asia-Pacific Region*, *World Bank Staff Occas. Papers, No. 17*, Johns Hopkins Univ. Press, Baltimore, 1974; and Joseph Grunwald and Philip Musgrove: *Natural Resources in Latin American Development* (published for Resources for the Future, Inc., by The Johns Hopkins Press, Baltimore, 1970), p. 452.

⁴ A similar independence is shared by other corporate enterprises, such as oil extraction. See Peter R. Odell and David A. Preston: *Economies and Societies in Latin America: A Geographical Interpretation* (John Wiley and Sons Ltd., London, 1973), p. 153.

⁵ Mestizo control of the native labor force produces a constellation of ills. Although logging usually involves small numbers of Machiguenga, the participation of these few workers can be responsible for significant disruption of the native society. Dependence on trade goods, labor obligations, disease, and a new spirit of resource and human exploitation spread from the members of work groups to the larger native population. This matter is of great importance; too great, in fact, to be treated adequately in the present discussion. For examples of the social impact of logging, see Robert L. Carneiro: *Logging and the Patrón System among the Amahuaca of Eastern Peru*, *XXXV Congreso Internacional de Americanistas, Actas y Memorias*, Mexico City [1962], 1964, pp. 323-327; and Stéfano Varese: *Relaciones interétnicas en la selva del Perú*, in *La situación de indígena en América del Sur* (edited by Georg Grünberg; Consejo Mundial de Iglesias y del Instituto de Etnología de la Univ. de Berna, Geneva, 1971), p. 166.

⁶ Wood exports from Peru have decreased, from 15,000 metric tons in 1955 to 4,000 metric tons in 1967, even though production has risen. This is largely the result of a strategy to reduce imports, which account for about 50 percent of the wood consumed in Peru and which have tended to slow development of domestic forestry enterprises (Victor M. Pinedo del Aguila: *Evaluación económica de los recursos forestales de la Amazonia peruana* [Instituto de Investigaciones Económicas, Lima, 1967], p. 62). The effort to reduce imports is shared with other Latin American countries (Grunwald and Musgrove, *op. cit.* [see footnote 3 above], p. 451).

⁷ "Tropical Timber" (Organisation for Economic Cooperation and Development, Paris, 1968), p. 80.

⁸ Commercial banks will not lend money to local patrons because the latter lack collateral and because the area in which they expect to invest is considered too distant for adequate bank supervision.

additional profits by providing only a part of the value of the loan in cash. The remainder is delivered in the form of materials needed for the logging operation: outboard motors, gasoline, oil, axes, machetes, clothing for workers, shotguns, and cables. These materials are valued at the Urubamba local price, which may be 100 percent above the retail price in Pucallpa, the closest major market. Since the patron who receives the loan does not usually have the means to transport goods or the capital to buy them in bulk, he must accept the locally elevated prices.

The result of this form of financing is to limit the amount of capital available at the local level, to minimize profits among those who carry out the actual extraction of wood, and to maximize profits among the major urban-based lenders. The capital thus accumulated is reinvested not locally but in large-scale, usually urban, enterprises.

The detrimental effects of the chain loan system—which is the prevailing one on the logging frontiers of Peru—are clearly reflected in both the distribution of logging activities and the techniques of wood extraction. Characteristic, for example, is the restriction of logging to river margins. Although both cedar and mahogany, the two species most subject to exploitation,⁹ are found throughout interfluvial areas as well as along rivers, the cost of constructing deeply penetrating pathways is prohibitive.¹⁰ On the Urubamba the longest pathway I recorded was about 1.5 kilometers from the streambank; most ranged from 50 to 500 meters.

Also characteristic is the generally short distance from the area of tree cutting to supply points. The concentration of logging activity downstream from Sepahua (Fig. 1) and in its immediate vicinity illustrates this. Food and supplies are transported from Sepahua to the work site at the beginning of the logging season and periodically thereafter. Since repeated trips must be made, the cost of travel can be considerably reduced by minimizing the distance from the supply point to the logging site. Thus, the most distant sites are at the headwaters of the Sepahua and Mishagua rivers and require a maximum of eight days' travel to reach. On tributaries farther from Sepahua two loggers have reduced travel costs by locating their homes and swidden plots near their logging sites, among the Machiguenga Indians. In this way they can reduce their supply trips to Sepahua to once every three or four months. Most loggers, however, are not willing to isolate themselves to this degree from their own cultural milieu.

The remainder of logging activity upstream from the Sepahua and Mishagua rivers is carried on by the Machiguenga, who extract wood independently without borrowed capital, who have borrowed from a Sepahua entrepreneur to whom they are obliged to deliver the wood they secure (this being another method of reducing transport costs), or who have borrowed from Dominican missionaries who provide a local market for the wood and are responsible for floating it downstream to buyers in Sepahua or Atalaya (Fig. 1).

Another characteristic of the present system is the rudimentary level of tools and machines used in felling and transporting logs. The loggers I interviewed all ex-

⁹ Other species occasionally cut include moena amarilla (*Aniba* sp.), tornillo (*Cedrelinga catenaeformis* Ducke), and lupuna (*Choricia* sp.). Although of considerably lower value than cedar and mahogany, a concentrated stand or one located along a river margin may make removal of these other species economically worthwhile.

¹⁰ Pinedo del Aguila (*op. cit.* [see footnote 6 above], p. 123) estimates that 25 percent of the cost of unprocessed wood is accounted for by axe work associated with tree felling and pathway clearance.

pressed interest in applying a more advanced technology to wood extraction. Most often they mentioned the lack of capital as the reason for their failure to employ new machines. But they recognized that repayment of such an investment and increased operating costs would require a larger volume of wood to be extracted than at present. Unless they felt that unusually concentrated stands of cedar or mahogany could be found, they were not inclined to adopt technical advances. Some, in addition, mentioned the ease with which chain saws are damaged by inexperienced operators and by extremely hard or resinous woods.¹¹ Finally, wood extraction is a coordinated process that does not necessarily benefit from the increased efficiency of any one element. The delay, for example, in getting a tree bole to the stream bed often results from the difficulties in rolling the log sections (up to four per bole) and not in felling the tree or clearing the pathway. Thus, a chain saw would speed up the latter operations but contribute nothing to the speed with which logs are advanced. There would be no total time advantage, and expense would be greater. In addition to matters of efficiency, the adoption of machines has been limited by their high purchase cost, especially compared with the low cost of human labor.

Thus, although a few loggers based in Sepahua use chain saws and hand winches, the great majority fell and often buck large trees with axes. Without exception they depend on human labor for clearing pathways and for rolling the logs to streams. The only mechanical aids are the simple lever (*palanca*), a multiperson lever (*palancón*), wooden rails, and an elementary pulley system (*molinete*), the parts of which are made from wood.

The one-man lever consists simply of a thick pole about 2 meters long, with a flattened point for easy penetration below the log. Each worker prepares his own *palanca* with great care. The work group of from four to eight men then makes coordinated exertions and can effectively roll logs weighing up to nine tons on flat or slightly sloping terrain (Fig. 2). When the ground is flat a pair of wooden rails may be placed along the pathway to ease movement. However, when the surface is broken or undulating, or when the pathway is curved, a single rail is placed on the ground at the point where a change of direction will be required and at right angles to the axis of the rolling log. When the log is rolled onto the rail it can be pivoted easily in the desired direction. Double rails are not used on broken terrain since the log will slip too easily and will become difficult to control.

The bottom bole from the trunk, if it is buttressed, must be rounded with an axe before it can be rolled to a stream. Likewise, the main trunk of the mahogany tree is sometimes oval and also must be laboriously rounded. Finally, main branches often of sufficient diameter to serve for timber are usually left where the tree is felled since their curved or twisted shape makes rolling them almost impossible.

The multiperson lever is sometimes used when a single obstacle, such as a small rock outcrop, must be passed. It is used in fundamentally the same way as the single-person lever; the difference lies in its size and the number of people needed to carry out the levering action. The *palancón* consists of a pole as thick as a man's body and 5 or 6 meters long. It is provided with a crude point. On the opposite end a notch is cut into the top side of the pole. This accommodates a steel cable or mass of thick vines, from which is suspended a tangle of heavy tree limbs. A high fulcrum of logs is provided at its base. When the log is to be moved the workers suspend themselves

¹¹ Y. Tailleur: Techniques d'abattage à la hache en forêt équatoriale africaine, *Bois et forêts des tropiques*, No. 83, 1962, pp. 49-53, reference on p. 50.

from the hanging tree limbs. If the calculation of weights has been accurate, the lever will force the log over the obstacle which was blocking its way. If greater advance is required the whole apparatus must be set up again and the laborious process repeated.

The most sophisticated of the machines built from the available forest materials is the molinete. It is used for moving logs up slopes where unaided human power is



FIG. 2—Palancas are used to move a cedar log near the Pongo de Mainique. If the log is to be pivoted, the workers will concentrate their effort at one end, as in this photograph.

insufficient and for guiding logs down steep slopes, to assure that they remain in the pathway and are not carried by their momentum into the forest.

There are various types of molinetes, selected according to the steepness of the slope, the weight of the log being transported, and the availability of standing trees to use as vertical supports. In general, the molinete consists of a horizontal pole about 2 meters above the ground, lashed with vines to two standing trees or deeply embedded posts, one on each side of the logging pathway. Midway between them a log 30 to 45 centimeters in diameter is planted vertically in the ground and secured by vines to the horizontal beam above. This standing post has either a Y-branch or a hole axed in it about waist height. A long push pole is placed in the natural branch cradle or through the hole. When the log is to be moved, the workers (two or three on each end) turn the central post by pushing this pole around in a circle. The pole length determines the mechanical advantage of the machine (Fig. 3).

A metal cable is given three or four turns around the base of the vertical post, and the remaining cable is brought downhill to the log and wrapped around it three times.

As the workers rotate the central post, cable is taken up and the log below advances. When all the surplus length has been used the log is secured on its downside with embedded palancas. The cable is run back down the hill, and the process is repeated.



FIG. 3—A molinete, near the Pongo de Mainique. A cable extends from the central post to the log section at the bottom of the hill (behind and below the photographer). One end of the cable is given three turns around the central post, and the other is placed around the log section. When the workers turn the pushpole, the cable is taken up in a manner similar to a windlass. Once the log has reached the crest of the hill where the molinete has been set up, the central post is removed and the log is rolled under the horizontal beam. (A cedar log that has already passed the molinete is visible in the background.) The post is then implanted again and relashed with vines, and the procedure is repeated with the next log.

In a hilly area, the same molinete will be planted and used at numerous points along the pathway. When the stream bank is approached or level ground is reached, it is abandoned.

These mechanical aids augment brute human strength only to a limited degree and are time-consuming to make and to use. Nonetheless, in the absence of animal power, massive human power, railways, or modern machine power ranging from winches to tractor crawlers, the ability of a few men to move objects of such tremendous weight is striking.

ENVIRONMENTAL CONSTRAINTS ON LOGGING ACTIVITIES

The level and nature of selective logging activity is, then, in part a function of economic imperatives: the availability of capital, the manner in which capital becomes available, the costs of transportation, market prices, and the feasibility of machines. Along the Urubamba these economic factors have conspired to limit the areal range and productivity of logging enterprises.

Environmental influences also tend to limit the area subject to exploitation and even the character of the logging operation. The most severe environmental constraint is the absolute dependence on tributary streams for log transport. There is no system of roads or railways, as there is with corporate logging.¹² The "easy" cedar and mahogany located on the Urubamba was cut beginning in the late 1940's. Trees were felled directly into the river, eliminating the need to construct pathways and transport logs to the riverbank. At present, however, the streams along which valuable trees still grow are situated far up the Urubamba and its tributaries. In the headwaters of these tributaries, such as the Mishagua, streams rise to levels adequate for transporting logs only three or four times a year. If the logs are not ready at the stream bank when the infrequent flash floods occur, or if the floods fail (as they did in 1973-1974), no wood can be removed until the following year, in which case the logger fails to repay his loan and is unable to meet the debt incurred to his workers.¹³ Furthermore, these headwater streams are narrow and twisting and must be cleared of trunks and other forest debris for their entire length so that the logs pass freely during floods. Beginning at the place where a stream becomes navigable, workers in dugout canoes follow the logs in order to release them from eddies, obstacles, and sandbars. The odds against uneventful log passage apply to canoes as well. It is not uncommon for a canoe to be overturned and its entire contents lost, or for people to be injured or killed.

When the stream does rise sufficiently to transport the logs, another group of workers waiting downriver must pick them out and secure them from among a mass of floating debris brought by the flood.¹⁴ The operation is hazardous, and canoes or logs are frequently lost. When the flood comes at night the difficulties are compounded. Debris cannot be distinguished from log, and as a result great quantities of wood may be lost downstream. Logs are sometimes stranded on beaches the following day, but if they reach the Urubamba they are picked up by river-margin residents who change or obscure the logger's mark axed into each log and sell them as their own. In a bad year loggers lose up to half of the wood they cut and transport to stream banks.

In a more general way than stream flow, seasons can affect logging operations. The proper times in which to locate, cut, and transport logs to river margins are sharply limited. Work does not begin until midsummer to late summer, after home gardens have been planted and government licenses (available beginning in June) and a labor force have been secured, but the first group of logs must be readied by December, when floods begin. Numerous workdays are lost, however, because of rain. Logs cannot be adequately controlled on the slippery vegetation and rails. The safety of the workers is endangered and the complexities of transport are increased when logs slide sideways off the pathway and into the forest, or when they shift unexpectedly.

These rainy days are used for hunting and fishing, cutting new pathways, or

¹² For an example, see George E. Doverspike, Paul Zehngraft, and Hsing-chi Yuan: *Forest Resources of Taiwan, Forestry Series, No. 3*, Chinese-American Joint Commission on Rural Reconstruction, Taipei, 1956.

¹³ Both cedar and mahogany are resistant to rotting and thus are usually marketable despite a year or more on the forest floor. This is not the case, however, with the majority of commercial woods.

¹⁴ Sometimes the small stream in which logs begin their downstream journey will be purposefully blocked at its confluence with a larger stream. Poles are implanted upright in the stream bed, retaining the logs that are brought during floodwaters. Although this arrangement prevents log loss, it has the disadvantage of slowing downstream movement of logs. While it is being dismantled the flood may suddenly cease, in which case the logs will run aground before reaching deeper water. Further transport must then await the next flood.

recreation. In general, activity is extremely intense between December and February, in large part because the logger succumbs to the attraction of felling more trees, despite the chance that the time lost to new cutting will endanger transport of the wood already cut, should streams fail to rise again.

Also acting as a constraint inherent in the local environment is the nature of the terrain. All of the major streams have floodplains, but they tend to be narrow,



FIG. 4—A rudimentary bridge across a drainage depression, Mishagua River. A similar construction technique (nested posts and top rails) is used to provide side support on pathways which follow the top edge of a narrow ridge. Railings such as those shown here are built along either side of, and on an even level with, the ridge spine. The result is a surface both flat and conveniently broad for rolling logs.

particularly in the southern portion of the lower Urubamba and in the headwater region of tributaries. Beyond the floodplain there is often an extremely dissected terrain of steep slopes and few continuous ridges. In the low portions between hills drainage may be poor, posing particular difficulties for the passage of heavy logs. Drainage depressions are crossed with simple bridges (Fig. 4). Steep hill slopes, since they make log transport with the palanca impossible, require use of the molinete. If the log is to be rolled along a ridgetop pathway, side supports become necessary.

When completed these supports look from above like a wooden railroad track, with each rail running on one side of and parallel to the axis of the ridge. The construction method, consisting of implanted posts with Y-branch or nested tops and rails placed in these nests, is the same as that used for bridges (Fig. 4). The rail and ridge surface is only partial, because most of the log being rolled is not underlaid by ground, especially when the ridge is narrow and its slopes are steep. But it is also a broad surface, permitting the log to be advanced without danger of its slipping to either side of the ridge. Hills and other natural obstacles, as these logging transport devices illustrate, increase the cost of extraction precipitously, thus restricting activity to flat areas and to those hilly areas closest to streams.

One of the outstanding characteristics of the tropical rain forest, and a further natural constraint on logging, is the extreme heterogeneity of its composition. Nonetheless, in Peru 80 percent of the trees logged belong to just five species, two of which are cedar and mahogany.¹⁵ Trees of these two species, like most others in the tropical forest, are widely scattered. The average concentration of mahogany is about one to two trees per hectare.¹⁶ Cedar is usually similarly dispersed, but occasionally it is found in concentrations of several trees to the hectare. As a result of these low densities, attempts to achieve economies of scale are almost invariably frustrated.

A final consideration is tree size. Legal minima are 25 inches diameter for mahogany and 18 inches for cedar, but when the cost of extraction is raised owing to difficult terrain or distant streams only trees considerably larger than the minimum justify removal. At the other extreme, especially large trees are often left standing because of heart rot or other damage common to overmature timber. Furthermore, the imperative of river transport restricts logging to trees that will float. Many valuable tropical hardwoods, including walnut (*Juglans neotropica*), do not.

The thrust of all these factors is the same. Of a heterogeneous forest very few widely scattered trees have an adequate market price and suitable characteristics to warrant their removal. Attempts made to clear-cut tropical forest, with the intention of using the entire tree composition, have been restricted to sites accessible to roads, railways, or marketplaces.¹⁷ On logging peripheries such as the Urubamba, in contrast, highly selective extraction is currently the only method economically feasible.

THE ENVIRONMENTAL IMPACT OF SELECTIVE LOGGING

Various disturbances of the natural vegetation correspond to stages of the logging operation. The first is establishment of a base camp. The understory of the forest is cleared over an area of 100 to 300 square meters, depending on the planned length of stay and the number of men in the crew. Large trees are left standing.

Huts are constructed from poles, vines, air roots, and palms (*Iriarte* sp., *Elephantusa macrocarpus*, *Atalea excelsa*, and *Jesseria* sp.).¹⁸ Each worker, or sometimes a pair of

¹⁵ "Latin American Timber Trends and Prospects" (Food and Agricultural Organization of the United Nations, Economic Commission for Latin America, New York, 1963), p. 20.

¹⁶ L. Williams: Peruvian Mahogany, *Tropical Woods*, No. 31, 1932, pp. 30-37, reference on p. 32; F. Bruce Lamb: Status of Forestry in Tropical America, *Journ. Forestry*, Vol. 46, 1948, pp. 721-726, reference on p. 722; and Hernando de Irmay: La caoba, *Swietenia macrophylla* King, en Bolivia, *The Caribbean Forester*, Vol. 10, 1949, pp. 43-52, reference on p. 45.

¹⁷ Michael Nelson: The Development of Tropical Lands: Policy Issues in Latin America (Johns Hopkins Univ. Press, Baltimore, 1973), p. 153.

¹⁸ Identification of plants is based on widely used common names whose corresponding scientific name has been located and cross-checked among the following sources: Robert L. Carneiro: Hunting and

workers, will construct a small shelter and help in constructing a larger one for the patron, where the camp supplies are stored. A small kitchen may also be built. Wooden floors and sleeping platforms are often constructed of chonta palm (*Iriarte* sp.), whose hollow trunk may be split vertically at close intervals, forming a series of connected slats which can be laid flat. The area immediately surrounding the camp-



FIG. 5—Machiguenga workers arrange cedar logs in order to form a raft, near Camisea. Vines are used to anchor and then bind the logs together. Stingrays are an unseen danger. They lie on the mud bottom of shallow waters and strike if they are stepped on.

site yields all the necessary vines, palm leaves, and saplings for camp structures. But because these plants are few, and because most of the understory and all of the overstory is left intact, few changes are immediately apparent.

During the subsequent months in camp other plants in the surrounding forest are used. Various palms (*Euterpe* sp., *Guilielma speciosa*, and *Astrocaryum* sp.) may be cut for their edible shoots. A tree may be felled if a beehive is detected in its crown. Trees may be tapped for rubber (*Hevea* sp.), chewing gum (*Macroubea paucifolia*), or the sweet-tasting sap from the milk tree (*Couma macrocarpa* Barb.). Bark may be stripped from trees (especially *Cecropia leucocoma*) for fiber, to be used in hut construction and

Hunting Magic among the Amahuaca of the Peruvian Montaña, *Ethnology*, Vol. 9, 1970, pp. 331-341; R. Lao Magin: Catálogo preliminar de las especies forestales del Perú, *Revista forestal del Perú*, Vol. 3, No. 2, 1969, pp. 3-61; "Manual de funciones, Zona Agraria VIII" (Ministerio de Agricultura, Iquitos, Perú, 1971); José A. Burgos: Silvicultura en Tingo María, *Programa Cooperativo de Experimentación Agropecuaria* (Lima), *Boletín* No. 12, 1954; Pinedo del Aguila, *op. cit.* [see footnote 6 above], pp. 9-24 and 31-48; Ruiz Abelardo Gutiérrez: La dendrología en la forestación, *Octava Convención Agroeconómica Regional, Segunda de la Selva*, Vol. 2, Tingo María, Perú, 1963; Estudio del potencial de los recursos, *op. cit.* [see footnote 2 above].

by Indian workers in making arrows. Arrow shafts (*Gynerium saggitatum*) are gathered along streams, and points are made from the hard wood of the chonta palm. Some trees (*Swartzia* sp. in particular) are used for making axe handles and paddles because of their fine-grained and resilient wood. Reeds are collected on occasion for making flutes and bark fibers or graminces for weaving crude baskets. Finally, when logs are transported downstream during floods the surrounding forest is combed for thick yet flexible vines suitable for binding the logs together into rafts (Fig. 5).

The variety of plants mentioned are scattered in the forest, and they are harvested or used over a period of several months. Most camps are inhabited for a single season, but occupancy ranges from as little as two or three weeks to a maximum of two consecutive seasons. In general terms, except for the occasional felling of trees for honey or fruit, the forest structure in the area surrounding the camp is not affected by the presence of loggers.

The second stage of logging operations involves felling the valuable tree and opening a pathway to the nearest stream. The clearing produced by a mature tree fall is between 30 and 50 meters long, corresponding to the actual length of the tree plus the bowling-pin effect at the crown end. The width of the canopy disturbance, which controls the amount of direct sunlight entering the forest, varies from zero along the base of the bole to 20 meters at the crown. The average felling disturbs from 0.02 to 0.04 hectare.¹⁹ The presence or absence of climbers, the size of the tree being felled, the terrain, and the depth of the soil (and thus of rooting) will affect this figure. The soil is generally not disturbed at the felling site and is usually covered with a thick mantle of fallen leaves and limbs. To the side of the fallen bole an area of about a meter on each side is cleared of vegetation, for ease of movement and to allow bucking the bole into sections.

Pathways are constructed from the fallen tree to the stream (Fig. 6). If possible their routes will avoid steep slopes and swamps, and an attempt is always made to feed into existing pathways. This may lengthen the distance that the logs will have to be rolled, but it reduces the amount of new pathway clearance. Mature and fully buttressed trees are always avoided because the axe work required to clear them at ground level would be extremely arduous. Pathways vary in width from 5 to 8 meters, depending on the terrain and the length of the logs to be removed. Most parts of the pathway are exposed to direct sunlight at some time during the day, though the amount varies significantly. Tall, full-crowned trees, an especially narrow pathway, or bamboo stands (which from the sudden lack of side support lean into the open space of the pathway soon after its construction) all contribute to increased shade. To the sides of pathways for a distance of 2 to 30 meters a penumbral zone of minor disturbance results from the felling of trees during pathway construction. Limbs and ground bushes are piled up along pathway borders. In this zone little additional light reaches the forest floor.

Trees within the pathway clearing are cut off flush with the soil surface, which must be flat for the logs to be rolled. This is extremely laborious because numerous species are buttressed or stilt-rooted. The vegetation is removed to the side of the pathway, but in the process of cutting, large amounts of leaf-fall cover the ground (Fig. 7). Proximity to stands of bamboo (an abundant producer of leaf-fall) and to

¹⁹ H. C. Dawkins: The Management of Natural Tropical High Forest with Special Reference to Uganda, *Imperial Forestry Inst. Paper No. 34*, Univ. of Oxford, 1958, p. 142.

deciduous trees which have recently shed also provide a source of leaf-litter. In the undisturbed forest leaf-litter depths range from zero to 4 centimeters, averaging about 3 centimeters on flats or gentle slopes. In corresponding terrain the depth of litter



FIG. 6—A worker poses with a ground bridge (poles placed lengthwise across a shallow depression), Mishagua River. This logging pathway is wider than most because of the uneven terrain: the extra width compensates for the erratic path that the rolling log will necessarily take.

generally exceeds these figures immediately after pathways are constructed.

While logs are being removed the use of levers and the molinete causes some soil disturbance where levering is especially arduous, where holes are made by posts planted to retain the logs on slopes, and where a molinete is set up and a circular pushway results. These, however, are minor and localized. Of greater impact, though infrequent, are trees that have been uprooted by chain-reaction falling. Holes of 0.5 to 1 meter deep and 3 meters in diameter are formed by the uprooting of large trees.

OBSERVANCES ON FOREST DISTURBANCE

Logging as practiced on the Urubamba involves observable changes in the forest vegetation, but a measure of its impact, given the relative nature of that term, requires



FIG. 7—Litter accumulation on a pathway, Mishagua River. Leaf-fall may be intense, protecting the soil from insolation and erosion. Bamboo and forest debris fall into the pathway soon after its construction.

at least a passing consideration of other sources of disturbance to tropical forest. These may be divided into three categories: agricultural clearing, harvesting of wood for fuel, and fully mechanized logging. In light of these influences selective logging appears to be a minor contributor to the changing face of Amazonia.

Michael Nelson estimates that between 5 and 10 million hectares of tropical forest are cleared annually in Latin America.²⁰ Almost all of the land is cleared for agricul-

²⁰ Some of this area may be secondary forest. See Nelson, *op. cit.* [footnote 17 above], pp. 145-146.

tural purposes (including ranching, plantations, and shifting cultivation), not for timber production. Formerly the forest cover was maintained despite the slash-and-burn practices of Amazonian Indians, but population increases and political decisions favoring colonization of the rain forest and establishment of pasture have altered the balance between growth and destruction of trees. Most of the trees felled for agriculture are burned *in situ*, for reasons of convenience and because their transport from the site is in most cases impossible.²¹

Second to agricultural clearing as a cause for the depletion of Amazonian forest is the use of wood for fuel. Some timberland has been used commercially in the production of coke for the metal industry,²² but most is used for home cooking and heating. In Peru, for example, more than 80 percent of the timber removals are for firewood and less than 20 percent for industrial wood, a ratio shared with other South American nations.²³ Thus, logging is seen to account for only a small part of total wood consumption, just as it accounted for, in comparison with agriculture, a small part of the total land area cleared of forest.

The degree of environmental change effected by cedar and mahogany logging may also be measured by means of a comparison with mechanized logging as practiced in parts of the tropical world. On the Urubamba cutting is restricted to the immediate stream area as a response to market prices, difficult terrain, and dependence on the stream for long-distance transport. However, cedar and mahogany are distributed throughout the interfluvial areas, so only a small percentage of their numbers is removed. In contrast, mechanized logging operations as practiced in much of Africa, Southeast Asia, and parts of Central America depend on roads that are constructed precisely to tap stands of valuable trees, however far removed. These stands are discovered not in random fashion from the ground (as they are on the Urubamba), but by using airplanes and sophisticated and thorough spotting techniques.²⁴

Where animals have replaced human power the areal extent of logging is also increased, though less dramatically than with roads.²⁵ In British Honduras animals replaced human power in 1805, when the mahogany accessible under the more primitive system was depleted. In the 1920's tractor crawlers entered use when the

²¹ The minor contribution of logging to land clearance that I observed in eastern Peru has numerous precedents in Latin America. See, for example, Frank H. Wadsworth: Notes on the Climax Forests of Puerto Rico and Their Destruction and Conservation Prior to 1900, *The Caribbean Forester*, Vol. 11, 1950, pp. 38-47.

²² Joshua C. Dickinson, III: Research on Forests and Man in Latin America, in *Geographic Research on Latin America; Benchmark 1970* (edited by Barry Lentnek, Robert L. Carmin, and Tom L. Martinson; Ball State Univ., Muncie, Ind., 1971), pp. 215-218, reference on p. 218.

²³ At least half of all wood that is cut is consumed as fuel in every country in South America (Grunwald and Musgrove, *op. cit.* [see footnote 3 above], p. 457).

²⁴ F. Bruce Lamb, Mahogany of Tropical America [see footnote 1 above], p. 37.

²⁵ Methods of nonmechanical log hauling are the offspring of specific cultures and places to a greater degree than are modern mechanical methods. In British colonies, for example, large hauling gangs (of up to a hundred workers) were characteristic. In other tropical countries the available domestic animals are used. These include elephants, camels, buffalo, oxen, horses, and mules. See Arthur Unwin: *West African Forests and Forestry* (T. Fisher Unwin Ltd., London, 1920), p. 156; Tom Gill: *Tropical Forests of the Caribbean* (Tropical Plant Research Foundation, Baltimore, 1931), illustration opposite p. 118; "Logging and Log Transport in Tropical High Forest," *Forestry Development Paper No. 18*, FAO, Rome, 1974, pp. 21 and 47; *Proc. Sixth British Commonwealth Forestry Conference, 1952*, Edmond Cloutier, Queen's Printer and Controller of Stationery, Ottawa, 1953, pp. 268-273; Leslie R. Holdridge: *Middle America*, in *A World Geography of Forest Resources* (edited by Stephen Haden-Guest, John K. Wright, and Eileen M. Teclaff; Ronald Press Co., New York, 1956), pp. 183-200, references on pp. 191-192; F. Bruce Lamb, Mahogany of Tropical America [see footnote 1 above], p. 35; and Romesh Chandra: Wood Transport Problems of India, *The Indian Forester*, Vol. 98, 1972, pp. 537-542, reference on pp. 540-541.

wood accessible with animal power had been exhausted. On the Urubamba, where conditions still dictate the use of human power, only a small percentage of the total area has been culled of valuable timber. As practiced, logging is severely and necessarily limited in its areal extent. If external economic conditions were to change sufficiently to offset the local environmental difficulties, logging operations would also change. Should the large tracts of untouched forest of the lower Urubamba be logged selectively or wholesale, it will not be done with the current methods.

In addition to areal extent, other differences in the environmental impact of rudimentary and modern logging become apparent. In the case of the former, pathways retain a cover of humus and leaf-fall after the logs have passed. Except on a localized scale, soil erosion does not occur. On the other hand, as vehicles use roads and skid trails they create quagmires in the rainy season and hardpans in the summer. Soil disturbance is so extreme that some foresters have expressed concern for the ability of these mechanically logged areas to support regeneration of valuable species.²⁶ Animal logging, though less extensive, can also be responsible for extreme soil disturbance. In the case of both mechanized and animal transport, logs that are not lifted entirely onto animal carts or carried via cableways are dragged with one point on the ground, plowing the soil and eliminating the thin organic A₁ horizon. With massive human power, logs may also be dragged, as was the practice in many British colonies until after World War I. Rollers reduced friction but undoubtedly delayed the return of ground cover and slowed the entire process of succession.

In contrast with mechanized operations, logging on the Urubamba does not usually require that pathways exceed the length of logs by more than a few feet. Consequently, the seed source for regeneration remains close, and temperature and humidity in the pathway do not differ as greatly from forest values as they do with mechanical logging and accompanying access roads, which require a cut 10 or more meters wide.²⁷ Clear-cut areas, often of tremendous extent, are responsible for even greater local environmental extremes.²⁸

Because local climatic and substrate desiccation associated with the narrow pathways of rudimentary logging is minimized, mature forest species will regenerate more rapidly than weedy species dependent on conditions of disturbance. The preference of cedar and mahogany for open conditions, discussed below, may in some cases be satisfied by the disturbance associated with mechanized logging. It appears, however, that side protection and some shade are required during the seedling stage, which would tend to discourage their reproduction in areas of extremely open conditions.²⁹

REGENERATION OF THE FOREST

Tropical rain forest, except at its climatic or edaphic limits, has extraordinary recuperative powers. This is due in part to its ecological stability, a function of complexity and species diversity. It is also due to high rates of production, perhaps

²⁶ *Proc. Sixth British Commonwealth Forestry Conference* [see footnote 25 above], p. 273.

²⁷ *Logging and Log Transport* [see footnote 25 above], p. 52.

²⁸ For examples, see R. L. Brooks: *The Regeneration of Mixed Rain Forest in Trinidad*, *The Caribbean Forester*, Vol. 2, 1941, pp. 164-173, reference on pp. 166-167; and Ned Andrews: *Tropical Forestry: The Timber Industry Finds a New Last Stand*, *Sierra Club Bull.*, Vol. 58, No. 4, 1973, pp. 4-9.

²⁹ F. Bruce Lamb, *Mahogany of Tropical America* [see footnote 1 above], p. 99; José Marrero: *Reforestation of Degraded Lands in Puerto Rico*, *The Caribbean Forester*, Vol. 11, 1950, pp. 3-15, reference on p. 12; and Samuel J. Record: *American Timbers of the Mahogany Family*, *Tropical Woods*, No. 66, 1941, pp. 7-33, references on pp. 16 and 30.

the highest in the world.³⁰ From the point of view of human intervention, the tropical forest has tremendous "ecological resistance."³¹ In instances where human activity has been intense and lasting this resistance has been broken, resulting in deflected successions and environmental deterioration.³² In the case of logging as practiced on the Urubamba, however, the limits of normal succession have not been exceeded. There is no cropping except for tree boles, so few plant nutrients are removed for human use. Leaching of soil nutrients after the forest cover is removed is also minimized, both because the period during which the ground is bare of vegetation is brief and because areas subject to logging are left with a layer of litter that reduces runoff and slows the downward movement of water.

Though minor as compared with other activities, selective logging is not without some effects on the soil. These are most severe on slopes and narrow ridges, where activity associated with log transport leaves the ground with only scattered litter fall. This tends to slow recuperation if localized erosion should result. Such erosion, however, is rare.

Humid depressions, with impermanent standing water, also harbor a reduced litter cover as the result of more rapid decomposition. Those parts of the pathway that are exposed to full sun, though initially carpeted with leaves, suffer degradation of the underlying A1 horizon, which is subsequently renewed after the plant cover returns. In a four-year-old pathway, for example, the undisturbed litter and humus-enriched horizons were almost completely restored. A thin mat of delicate roots found at the soil surface is subject to drying despite a litter cover. Pathway construction affects the root mat adversely, owing either to insolation or to the damage done to the above-surface plants, most of which coppice successfully.

In abandoned campsites, because the emergent trees have been left standing, regrowth of understory plants is slow. Pioneer species generally do not intrude because soil and ambient conditions remain close to those of the undisturbed forest. The only exceptions are temporary ones, including exotic plants such as avocado, papaya, lemon, and orange, from fruit brought to the camps. Although seedlings may be observed in recently abandoned sites they probably do not survive shade suppression for long.

The extraordinary ability of tropical hardwoods and palms to coppice is well evidenced in an abandoned camp. At one six-month-old site almost all of the saplings and lower-level trees up to seven inches in diameter had coppiced. New shoots ranged from 10 to 70 centimeters in height. Sections of trunks can also coppice, as can poles implanted in the ground for the construction of huts. In general, though, despite the tenacity of plants that repopulate campsites in mature forest, the aspect is open and uncluttered even two years after abandonment.

Regeneration is different when loggers have established their camp in an area of mixed bamboo and hardwoods or of pure bamboo. Here it is extremely rapid, uneven, and dominated by the single pioneering species, bamboo (Fig. 8).³³ In direct sunlight

³⁰ Daniel H. Janzen: Tropical Agroecosystems, *Science*, Vol. 182, 1972, pp. 1212-1219, reference on p. 1213.

³¹ David R. Harris: Plants, Animals, and Man in the Outer Leeward Islands, East Indies: An Ecological Study of Antigua, Barbuda, and Anguilla, *Univ. of California Pubs. in Geogr.*, Vol. 18, Berkeley and Los Angeles, 1965, p. 142.

³² William M. Denevan: Development and the Imminent Demise of the Amazon Rain Forest, *Professional Geogr.*, Vol. 25, 1973, pp. 130-135.

³³ Particularly long stretches of bamboo are common along both banks of the Mishagua River, and in

bamboo stalks reach a height of 70 centimeters within a month of cutting. Four months later they are between 3 and 5 meters tall. The canopy formed is uneven because in shaded areas the emergence of new shoots is delayed and growth is slow.



FIG. 8—A bamboo brake on the Mishagua River, seen during the dry season. This bamboo probably reflects forest clearing associated with the turn-of-the-century rubber boom. Except near its confluence with the Urubamba, there are no permanent inhabitants on the entire Mishagua. Only transitory loggers and nomadic (and still hostile) Yaminahua Indians are to be found.

Within a year the mature height (10 to 16 meters) is reached and all external traces of the loggers' presence are gone.

The forested periphery of a logging camp, culled primarily of palms but also of vines and saplings, returns to its former state slowly, without any intervening pioneer phase. All the ground palms used in thatching send out new shoots, some within two weeks. Saplings, as suggested above, will coppice in most cases, but it is uncertain the degree to which vines and the air roots of epiphytes regenerate themselves.

The assumption is often made that selective logging permanently impoverishes the forest of the particular species being logged. This is no doubt true for some tropical hardwoods, but evidence suggests that, in contrast to most tropical emergents, the regeneration of both cedar and mahogany is dependent on disturbance of the forest cover. Thus, though loggers remove mature trees, they also create conditions which favor the repopulation of the logging site by the same two species they have removed.

combination with hardwoods for at least 150 meters into the forest interior. Various investigators have suggested that stands such as these mark former human occupancy. See James J. Parsons: *Antioqueño Colonization in Western Colombia* (rev. edit.; Univ. of California Press, Berkeley, 1968), p. 25; Gill, *op. cit.* [see footnote 25 above], p. 75; and Doverspike and others, *op. cit.* [see footnote 12 above], p. 17.

The abundant stocks of mahogany in parts of Central America studied by F. Bruce Lamb correspond to wind-damaged hurricane areas.³⁴ Other investigators have observed concentrations of mahogany in former swidden sites.³⁵ In addition, it is a common silvicultural practice with cedar and mahogany to maintain the top canopy open, permitting full sunlight to enter. Perhaps because these trees are light-tolerant from an early age, their best development under natural conditions is not in tropical wet forest but in seasonal forest characterized by a more open canopy. A. F. A. Lamb notes that cedar does not regenerate well in logging areas in a humid rain forest but may do so in drier seasonal forest, such as that on the Urubamba.³⁶

Cedar and mahogany are not demanding in soil fertility and pH and can tolerate dry periods by dropping their leaves once they are past the seedling stage. They will grow on flatlands and slopes alike, but may be more abundant on slopes in part because their one intolerance—waterlogging—is avoided. Both are wind resistant, providing a seed source for establishment of new individuals where trees of other species have been toppled. Although cedar is somewhat less tolerant of waterlogging and poor soils than mahogany is, they are both clearly adapted to a wide range of conditions.

The correspondence between the distribution of these trees and areas of catastrophic and anthropic disturbance is well documented.³⁷ It is through the provision of conditions favorable for seed germination and sapling growth that this correspondence is brought about. Trees on the Urubamba are felled beginning in August, but felling is concentrated in the period between October and December. Fruit ripens and seeds are dispersed at the end of the dry season, in August and September, before most trees are cut. Thus, an abundant supply of seeds will be on the ground and some may have germinated when the canopy is opened. Unlike most members of the climax association, cedar and mahogany have winged, windblown seeds. They are viable and are produced in large quantities, germinating within ten to fifteen days if sufficient moisture is available.³⁸ Winds are capable of scattering seed over a 4-hectare area on the leeward side,³⁹ so that not only the immediate stump site but also the surrounding forest may receive seed fall. When loggers cut down mature trees and construct pathways they are opening the upper canopy just when the abundant and widely distributed seedlings are emerging.

Other aspects of selective logging may contribute to conditions that are favorable for germination and seedling growth. The desiccation of the soil and litter surface reduces root competition, favoring the seedling that germinates with the first rain. Also, the mineral soil exposed directly around the fallen log, resulting from bucking and removing the log sections, is ideal as a germination bed for both trees. In forest

³⁴ F. Bruce Lamb, *Mahogany of Tropical America* [see footnote 1 above], pp. 110–111.

³⁵ N. S. Stevenson: *Silvicultural Treatment of Mahogany Forests in British Honduras*, *Empire Forestry Journ.*, Vol. 6, 1927, pp. 219–227; and A. K. Wolffsohn: *An Experiment Concerning Mahogany Germination*, *ibid.*, Vol. 40, 1961, pp. 71–72.

³⁶ A. F. A. Lamb: *Cedrela Odorata, Fast Growing Trees of the Lowland Tropics No. 2*, Commonwealth Forestry Inst., Oxford, 1968, p. 36.

³⁷ Budowski, for example, observed that "older secondary forests contain some species of the greatest commercial value, including Cedar and Mahogany" (Gerardo Budowski: *Los bosques de los trópicos húmedos de América, Turrialba*, Vol. 16, 1966, pp. 278–285, reference on p. 284). The pioneering capacity of these trees is also frequently noted. See, for example, F. Bruce Lamb, *Mahogany of Tropical America* [footnote 1 above], p. 91.

³⁸ In experiments reported by Burgos (*op. cit.* [see footnote 18 above]), the germination rates were 80 percent for cedar and 75 percent for mahogany.

³⁹ F. Bruce Lamb, *Mahogany of Tropical America* [see footnote 1 above], p. 96.

floor litter, insects and molds easily destroy the seed. For this reason, apparently, hillsides that are bare of litter are commonly the preferred location of established trees. In general, patches of exposed mineral soil, and thus cedar and mahogany, prevail in areas that have been disturbed by man, fire, or wind.⁴⁰

From the foregoing it should be expected that both the stump area and the radiating pathway will contain seedlings of the fallen tree, in varying degrees of abundance. Seedling survival, however, depends on the ability to compete with the somewhat delayed, but nonetheless extremely aggressive, herbaceous and woody pioneer invasion. In this respect cedar and mahogany seedling growth with full light and adequate moisture is relatively rapid. A cedar can grow 1 or 2 meters during its first season, reaching 6 to 8 meters in three or four years. Six-year-old mahogany trees have comparable heights of 6 to 11 meters. These rates are less than pioneers such as balsa (*Ochroma* sp.) and cetico (*Cecropia* sp.), however.

Available studies are contradictory in their assessment of the rate at which cedar and mahogany are being replaced. Although the reproductive ecology of these trees indicates that they are capable of, and may require, regeneration in the disturbed forest, areas subject to lengthy periods of cutting usually do not show a sustained yield. This is the case in eastern Peru, where production of the two species was in decline in 1974.

The cause of this decline is not clear. It may reflect the depletion of mature trees but not of seed stock, at least in areas such as the Urubamba. Most parts of eastern Peru have been subject to logging for fewer than twenty-five years, and as a result insufficient time has elapsed for the majority of young trees that remain after the initial cutting to reach maturity. Furthermore, since between sixty and one hundred years are required for cedar and mahogany to achieve their minimum legal girths, all the seedlings established at logging sites, assuming that reproduction is in fact occurring, are still small trees.

Where longer periods of selective logging are associated with depletion, it is because other factors have come to bear. These are not as yet of major significance on the logging frontier but they do undoubtedly contribute to reduced rates of replacement behind the frontier, and thus to the observed decline in production. Subsequent waves of salvage loggers, working under a less-restrictive set of economic constraints, extract utility woods in addition to the undersized cedar and mahogany remaining from the previous wave. Over time the entire population of the valued trees may be eliminated. The problem of species depletion, then, is not one of the methods of logging but rather of the frequency with which extraction occurs. Species depletion in the tropical forest is thus seen to be a cumulative phenomenon, not the work of loggers of virgin stands. They remove nothing from the forest which would not be replaced were subsequent loggers prevented from further cutting.

The most substantial disturbance in rudimentary logging results from the opening of pathways and the subsequent passage of logs. A pathway of average length has an area equivalent to a small agricultural opening (0.25 to 0.50 hectare). The rate and nature of regeneration is more rapid and direct following logging than following the abandonment of an agricultural site. The succession sequence is not interrupted, as it is with clearing and burning for each crop year. The rapid rate of change is largely a result of two factors: the initial soil conditions, which are less disturbed than after

⁴⁰ *Ibid.*, p. 90.

cropping in agriculture; and the rate of soil improvement during succession, a function of the immediately invading plant cover.⁴¹

Whereas deflections are induced by repeated clearing and burning, or in particularly dry marginal forests, they are not induced as a result of rudimentary logging in areas such as the Urubamba. Within fifty years of cutting the forest is restored to its original structure, differing from the climax primarily in the persistence of some secondary species and the paucity of other climax ones.⁴² The approach to the climax vegetation occurs at a progressively slower rate, and it becomes a matter of judgment when a forest has been restored to its original condition. Usual estimates are from one hundred to three hundred years.⁴³

On the Urubamba four stages in this succession to climax may be distinguished: vegetative repopulation, herbs, woody pioneers, and emergents. Plant growth begins a week or two after the initial clearing by loggers. Before the pathway has been used, which may be up to three months after it is constructed, the vegetation has begun its return to forest. This initial stage is not described by tropical ecologists, apparently because their data are gathered largely from agricultural clearings where burning is involved. It is a period of almost purely vegetative reproduction. The great majority of ground herbs, saplings, and some of the larger trees, broken off or chopped down, successfully coppice. Viable twigs, ground roots, and sections of vines also sprout. This growth occurs in a competitive void in which the success of a plant depends on its adaptability to full or partial sunlight. For a period of up to six months, seed plants are few.⁴⁴ Grasses are rare in most cases. Closer to major rivers the persistence of the coppice stage is somewhat less because the seeds of full-light species are more abundant. In general, for the first six months the ground remains sparsely populated by the same wide variety of plants (more than thirty were counted on a pathway abandoned for one month) originally found on the forest floor.

In time the variety diminishes as plants suited to shade conditions die off, prevailing only in shade-protected portions of the pathway, and as herbaceous seed plants begin to invade. These are characterized by rapid growth, abundant seed production, and the formation of a closed canopy, which suppresses competitors but allows the persistence of shade-tolerant forest species. Grasses may be present. Vines are occasionally abundant, but they are not, as often suggested, an inevitable component of the herbaceous stage. Among the factors that affect their presence are the quantity of herbaceous vines in the general area and the presence or absence of projecting support, such as tree trunk or fallen crown. Where support is lacking, vines often fail to compete successfully with stalked plants.

The most obvious characteristic of the herbaceous stage is the dominance of a very limited number of species in the top, nonuniform, canopy. Sections of bamboo alternate with pure stands of semiwoody and herbaceous brush. All contribute, however, to essentially the same ground-level conditions: minimal insolation, cooler temperatures, and greater humidity than during the initial coppice stage. The production of litter is intense, contributing to the reestablishment of the depleted A₁

⁴¹ L. R. Holdridge: *Life Zone Ecology* (rev. edit.; Tropical Science Center, San José, Costa Rica, 1967), pp. 60-61.

⁴² André M. A. Aubréville: *Tropical Africa*, in *World Geography* [see footnote 25 above], pp. 353-384, reference on p. 357.

⁴³ See, for example, Budowski, *op. cit.* [footnote 37 above], pp. 282-283.

⁴⁴ M. C. Kellman: *The Viable Weed Seed Content of Some Tropical Agricultural Soils*, *Journ. Applied Ecol.*, Vol. 11, 1974, pp. 669-678.

horizon on slopes, ridges, and portions initially subject to direct sunlight. More heavily shaded areas retain the greatest amount of organic matter. At the one site where comparison was possible, no difference in accumulation was observed between sandy and clayey soils. Within a year and a half after the initial clearing, the herbaceous level in full sun reaches 5 meters (3 meters in partial shade), though bamboo will reach the same height in five to six months.

The rising canopy and increasing ground-level light intensities provide for the emergence of a crop of woody pioneers. Like the herbaceous plants they come to replace, they seldom occur in the forest interior except at sites of recently blown down trees or along exposed streams. Their wood is soft and light, a function of their rapid growth. Balsa, cetico, and pashaco (*Acacia* sp.) are among a dozen common tree pioneers of the Urubamba and most of the Peruvian Amazon. The shade they provide is only partial, but it is sufficient to suppress herbaceous growth, whose reproduction is further hampered by its own canopy. At the same time, the woody pioneer cover allows for the growth of shade-tolerant species of the lower levels of mature forest and of climax species that are commonly shade-tolerant during the seedling and sapling stages.

LOGGING IMPACT AND THE RETURN OF CLIMAX FOREST

The final, open-ended stage of succession begins with the emergence of tall, generally heavy-wooded, and long-lived climax species. It is not clear, as mentioned earlier, when a late successional stage becomes a climax, in part because the forest structure matures early in the succession and in part because the rate of change from one association to the next is so slow.⁴⁶ It is also a result, perhaps more importantly, of the difficulty we often have separating things "natural" from things "human." Were loggers to cut a larger number of trees over a wider area than is now possible, with less dependence on the local environment and thus less constrained by it, the separation would become easy. The disturbance created (tropical clear-cutting suggests itself here) would be sweeping and long-lasting. It would constitute a significant impact.

Rudimentary logging, on the other hand, is highly selective and highly restricted in its areal extent. In this regard, a simple calculation of the total area per enterprise that is cleared or disturbed, compared with the total area subject to eventual exploitation, is revealing: tree-fall gaps may reach 0.04 hectare per tree, to which is added 0.5 hectare of cleared land resulting from an average pathway clearance. A zone of minor disturbance along the pathway border and to the side of the fallen tree bole averages another 2 hectares. An entrepreneur on the Mishagua, for the usual 50-hectare area which his license allows, may expect to find on the average five, six, or seven cedar and/or mahogany trees worth felling and removing. This is far below the number of individuals of these species within the area licensed to the entrepreneur, yet only these few satisfy all the conditions necessary to warrant removal. To review, these conditions include the size of the tree, its soundness, and its proximity to other valuable trees and to a stream.

If we assume that seven trees are removed, their total fall area will be 0.28 hectare. The total pathway area cleared will be much less than the simple product of trees times average pathway area. This is because a pathway is usually used for more than

⁴⁶ Alistair Foggie: Natural Regeneration in the Humid Tropical Forest, *Proc. Fifth World Forestry Conference*, Vol. 3, 1960, pp. 1941-1946, reference on p. 1942.

one tree, whenever possible, as a means of reducing axe work and thus labor costs. My field data indicate that a pathway will serve for an average of two or three trees. Hence, for seven trees, about 1.75 hectares will be cleared to the ground, and another 7 hectares will suffer minor damage to its middle and lower canopies.

This means that a total of about 2 hectares or 4 percent of the licensed area is cleared, and another 14 percent is slightly affected. These represent small amounts of land, particularly in light of the restriction of logging to stream margins. It is impossible, unfortunately, to determine the exact amount of land accessible to streams, but the most detailed maps of the study area which are available show accessible land to be only a small percentage of the total land area. Thus, the much greater percentage applies to land that will never be subject to selective logging as it is currently practiced.

Should Urubamba logging cover larger areas of forest in the future, it must be emphasized that the stimulus will not be found locally, nor will the current techniques of wood extraction be retained. Lumbering operations of the kind examined here do not affect the forest adversely. Distant decisions and economic imperatives do.

Like the native Machiguenga subsistence system, the umbilicus of Urubamba frontier logging is attached to the local milieu. Where it alters the land it does so gently, with wooden machines and human power. The forest reclaims what has been cut in the same manner that fallen trees and Machiguenga swidden sites have been claimed innumerable times before. The environmental changes brought about by selective logging are not lasting. The nature of its disturbance—isolated gaps in the forest cover—differs little from that responsible for the scattered occurrences of cedar and mahogany. Ironically, the *terra incognita* a logger imagines to be pristine was probably once the living space of other humans, working the same land with different purposes and with different tools. In a short time others may come to hold the same illusion; and in this is the measure of impact.

FOREST PRESERVATION IN THE WESTERN HIGHLANDS OF GUATEMALA*

THOMAS T. VEBLEN

THE rapid rate of human destruction of tropical forests and its ecological as well as social consequences is a theme of growing concern among both social and natural scientists. The implications of this massive landscape transformation in tropical America have been widely discussed with regard to the loss, or impending loss, of valuable forest genetic resources, accelerated soil erosion, and the destruction of wildlife habitats.¹ Geographers have contributed considerable historical perspective to the theme of contemporary vegetation modification in Latin America. Their studies have tended to focus on the influences of the aboriginal population on pre-Hispanic landscapes and on the landscape transformations that resulted from the demographic and technological impact of the European colonization of Middle America and South America. The long history of man's alteration of vegetation has been well established for numerous regions in Latin America.²

Although the magnitude of the deforestation problem should not be underestimated, vast areas in Latin America remain forest covered. Most of these forests lie in wet tropical lowland areas such as the Amazon Basin and the east coast of Central America, where population densities in the post-Conquest period have been relatively low. These tropical lowland landscapes are rapidly being deforested in association with both planned development projects and spontaneous colonization. In contrast, the highland areas of tropical America have been densely settled since pre-Hispanic times, and the forest cover either was removed long ago or is currently being destroyed. In the tropical highlands, forests generally persist only in the most remote and inaccessible areas.³

Most of highland Guatemala fits the norm of early and extensive forest destruction that has greatly accelerated over the past three or four decades.⁴ In several areas,

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¹ See, for example, R. J. Goodland and Howard S. Irwin: Amazonian Forest and Cerrado: Development and Environmental Conservation, in *Extinction is Forever* (edited by Ghilean T. Prance and Thomas S. Elias; New York Botanical Garden, New York, 1977), pp. 214-233; A. Gómez-Pompa, C. Vázquez-Yanes, and S. Guevara: The Tropical Rain Forest: A Nonrenewable Resource, *Science*, Vol. 177, 1972, pp. 762-765; and James J. Parsons: Forest to Pasture: Development or Destruction, *Rev. biología tropical*, Vol. 24, Suppl. 1, 1976, pp. 121-138.

² See, for example, Carl O. Sauer: *The Early Spanish Main* (Univ. of California Press, Berkeley and Los Angeles, 1966); William M. Denevan: *The Upland Pine Forests of Nicaragua: A Study in Cultural Plant Geography*, *Univ. of California Publ. in Geogr.*, Vol. 12, Berkeley and Los Angeles, 1961; and Carl L. Johannessen: *Savannas of Interior Honduras, Ibero-Americana*, Vol. 46, 1963.

³ Of course, parts of highland tropical America are too cold or dry to support a forest cover, and the exact extension of forests prior to human modification is a matter of dispute. See, for example, G. Budowski: *La influencia humana en la vegetación natural de montañas tropicales americanas*, *Colloquium Geographicum*, Vol. 9, 1968, pp. 157-162; and H. Ellenberg: *Montane Vegetation and Productivity in the Tropics, With Special Reference to Peru*, in *The Ecology of Man in the Tropical Environment*, *Intl. Union for Cons. of Nature Publ., New Ser., No. 4*, Morges, 1964, pp. 172-177.

⁴ Thomas T. Veblen: *The Urgent Need for Forest Conservation in Highland Guatemala*, *Biological Conservation*, Vol. 9, 1977, pp. 141-154.

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however, the forest cover persists. These include parts of the remote and high Cuchumatanes Mountains in the northwest, the highest altitudes of Sierra de las Minas in the east, the upper slopes of the volcanoes in the department of San Marcos in the west, and much of the department of Totonicapán (Fig. 1). This last area, Totonicapán, is of interest because it is accessible and well within the altitudinal limits of agriculture, yet it remains forested despite a long history of severe population pressure (Fig. 2). At the time of the Spanish Conquest, Totonicapán was one of the most densely settled areas in Middle America, and it continues to have the highest rural population densities in Guatemala.⁶ My objective in this paper is to evaluate the historical circumstances that have contributed to the preservation of the forests of Totonicapán.

TOTONICAPAN AND THE PRESSURE ON ITS RESOURCES

The department of Totonicapán covers approximately a thousand square kilometers in the volcanic highlands of western Guatemala, with altitudes ranging from 1,600 to 3,400 meters above sea level. Topographically this area is dominated by the María Tecún Ridge (Fig. 3), which consists of Tertiary lavas and which runs southeast-to-northwest, forming part of the drainage divide between the Pacific Ocean and the Atlantic Ocean. To the east of the continental divide, Tertiary welded tuffs predominate and in some areas have been eroded into striking pinnacle and spiral forms. To the southwest, Tertiary welded tuffs and lahars predominate on the upper slopes, but the structural basin, known as the Valley of Totonicapán and extending into the neighboring department of Quezaltenango, is filled with Quarternary pumice to depths of more than 100 meters.

Soils derived from the Tertiary volcanic deposits at altitudes of approximately 2,400 to 3,100 meters are more than a meter deep and have A horizons characterized by a high organic content. At higher altitudes, soils are distinctly thinner and in many cases the rhyolitic lavas are exposed. In northeastern Totonicapán, at successively lower altitudes, the A horizons developed on the Tertiary welded tuffs become increasingly thinner. Here the very compact, clayey B horizons are iron-oxide-cemented hardpans exposed in many places by erosion. The soils derived from the Quaternary pumice deposits in the Valley of Totonicapán are among the most fertile of the western highlands and are used almost entirely for agriculture.

At San Miguel Totonicapán (2,495 meters) monthly average temperatures vary from 9° to 14°C. November through March are the coldest months; May through September are the warmest.⁶ Frosts occur frequently at this altitude during the coldest months and throughout the year at altitudes above 3,000 meters. At San Miguel Totonicapán and at nearby San Francisco El Alto the annual precipitation, more than 90 percent of which falls from April through October, averages slightly over 1,000 millimeters. Precipitation increases at higher altitudes on the westward-facing slopes of the María Tecún Ridge; farther east, under the rainshadow influence of this divide, rainfall gradually diminishes.

The native vegetation of Totonicapán is a mosaic of mixed coniferous-broadleaf

⁶ Thomas T. Veblen: Native Population Decline in Totonicapán, Guatemala, *Annals Assn. of Amer. Geogrs.*, Vol. 67, 1977, pp. 484-499; "Octavo censo de población, 1973 y tercer de habitación (cifras preliminares)" (Dirección General de Estadística, Guatemala City, 1974), p. 19.

⁶ "Datos meteorológicos mensuales hasta 1959 inclusivo" (Inst. Geográfico Nacional, Guatemala City, 1968), pp. 447-448.

forests, open woodlands, brushlands, and grasslands. Within each of four physiognomic classes, vegetation types can be recognized on the basis of the relative abundance of the dominant species (Table I). Open pine and oak woodlands cover the



FIG. 1

northeastern third of the department at altitudes of approximately 1,600 to 2,000 meters where relatively arid conditions prevail; the thin soil lying above a relatively impermeable hardpan provides little volume for moisture storage during the long dry period. Accelerated erosion induced by sheep and cattle grazing has exposed the hardpan over large areas. The relatively moister conditions of the higher altitudes (above approximately 2,300 meters) are reflected by the development of dense pine and oak forests. Alders (*Alnus arguta* and *A. firmifolia*), cypress (*Cupressus lusitanica*), and madrone (*Arbutus xalapensis*) are also associated with the pine and oaks at the



FIG. 2—Satellite imagery of southwestern Guatemala, March 27, 1973; approximate scale 1 : 1,000,000. The large dark area to the northwest of Lake Atitlán (center) represents the most extensive area of pine forest in Totonicapán as well as in the entire country. *Source:* Earth Resources Technology Satellite (frame identification number 1247-15560).

TABLE I—VEGETATION TYPES OF TOTONICAPÁN

TYPE	APPROXIMATE ALTITUDINAL RANGE (In meters)	DOMINANT SPECIES ^a
Forests		
White pine	2700–3350	<i>Pinus ayacahuite</i>
Fir	2750–3350	<i>Abies guatemalensis</i> , <i>P. ayacahuite</i>
High-altitude red pine	2500–3400	<i>Pinus rudis</i> , <i>P. pseudostrobus</i>
Oak-pine	2000–2850	<i>Quercus acatenangensis</i> , <i>Q. pilicaulis</i> , <i>P. ayacahuite</i> , <i>P. pseudostrobus</i> , <i>P. rudis</i>
Low-altitude red pine	2000–2700	<i>P. pseudostrobus</i> , <i>P. oocarpa</i> , <i>P. montezumae</i> , <i>Cupressus lusitanica</i>
Oak	2000–2750	<i>Q. acatenangensis</i> , <i>Q. pilicaulis</i> , <i>Arbutus xalapensis</i> , <i>Alnus arguta</i>
Cypress	2500–2800	<i>Cupressus lusitanica</i>
Open Woodlands		
Pine	1600–2250	<i>P. oocarpa</i> , <i>P. montezumae</i>
Pine-oak	1600–2250	<i>P. oocarpa</i> , <i>P. montezumae</i> , <i>Q. acatenangensis</i> , <i>Q. pilicaulis</i> , <i>Arbutus xalapensis</i>
Brushlands		
Tall brush	2500–3400	<i>Baccharis</i> sp., <i>Buddleia nitida</i>
Dwarf scrub	2900–3400	<i>Acaena elongata</i> , <i>Pernettya ciliata</i>
Grasslands		
Bunchgrasslands	2350–3400	<i>Muhlenbergia macrooura</i> , <i>M. nigra</i>
Meadow	2800–3300	<i>Trifolium amabile</i> , <i>Geranium alpicola</i> , <i>Arenaria</i> sp., <i>Viola</i> sp.

^a Nomenclature follows Paul C. Standley and Louis O. Williams: *Flora of Guatemala, Fieldiana Botany Vol. 24* (Field Museum of Natural History, Chicago, 1958–1976).

middle elevations. Above approximately 2,850 meters the broad-leaved trees are absent (with the exception of the alders), and the Guatemalan fir (*Abies guatemalensis*) becomes an important component of the pine forests. Although a true upper forest limit or tree limit is not reached, bunchgrasslands maintained by sheep grazing are frequently encountered at the upper altitudes.

Of the approximately 170,000 inhabitants of Totoncapán, more than 90 percent are Quiché-speaking Maya Indians.⁷ The non-Indian inhabitants, known as *ladinos*, are racially mixed (Spanish and Indian) but are culturally distinguished from the Indian population by their language, dress style, religion, and generally Western cultural characteristics. The Indians are descendants of the Quiché nation, which was the most powerful native group in Guatemala at the time of the Spanish Conquest.

The department of Totoncapán is subdivided into eight *municipios*, or townships, each of which is a distinct ethnographic unit. The population of each *municipio* tends to be endogamous and speaks a slightly different dialect. These *municipios* are further subdivided into well over a hundred small dispersed settlements known as *cantones*, *caseríos*, or *aldeas*. In some cases *parcialidades*, which are clans or extended kinship groups, also form separate settlements. The only nucleated settlements are the *cabeceras*, or capitals, of the eight *municipios*.

In terms of employment and income, the dominant economic activities of Totoncapán are artisanry, marketing, and agriculture. Totoncapán is the principal source of the inexpensive pine furniture that is sold throughout Guatemala, and cutting for lumber as well as for firewood is a major occupation. Pottery making is

⁷ Octavo censo [see footnote 5 above], p. 19.

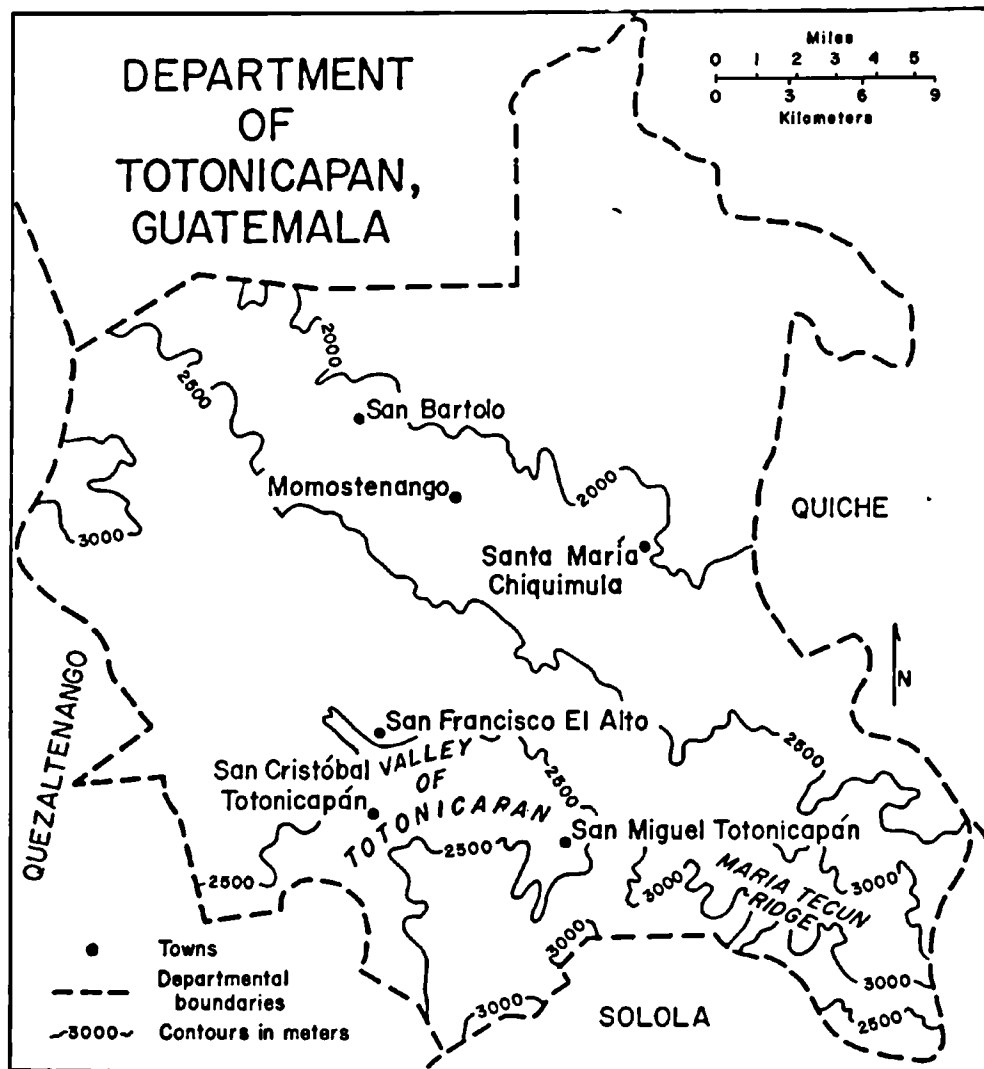


FIG. 3

another important occupation, especially in the municipios of San Cristóbal Totonicapán, San Miguel Totonicapán, and Santa María Chiquimula. Agricultural production is for both subsistence and commerce. The most important crops at the higher altitudes (that is, above 2,200 meters) are maize, European broad beans, and wheat; at lower altitudes mixed fields (*milpas*) of maize, squash, and beans predominate. Sheep raising is also important.

The land tenure system of Totonicapán is an example of severe *minifundismo*—the fragmentation of agricultural holdings into *minifundia*, or small holdings. Of the 23,000 farms in Totonicapán, over half are less than 0.7 hectare in size; and of these smallest holdings, half are divided into parcels.⁸ Ninety-eight percent of the farms in Totonica-

⁸ "Censo agropecuario, 1964" (5 vols.; Dirección General de Estadística, Guatemala: City, 1968), Vol. 1, p. 120.

pán are too small to meet the minimal subsistence needs of a family of five. Malnutrition is severe, and in some years more than 10 percent of the deaths in Totonicapán are attributed directly to malnutrition.⁹ The two-thirds increase in population during the past twenty-five years is reflected in the drastic intensification of land use.¹⁰ In the 1930's a fallow period was characteristic of both wheat and milpa cultivation, but today most farming is intensive and permanent.¹¹ Almost all of the families in Totonicapán cultivate their own milpa, but they must also seek income from other types of activities, some of which are based on forest resources. The forests of Totonicapán are exploited for lumber, firewood, *ocote* (resinous splinters), and a variety of other products. In association with an 80 percent increase in the human population over the past forty years, the intensity of this utilization has risen markedly.

The preferred lumber for the furniture industry is white pine (*Pinus ayacahuite*), although the other pine species are also commonly used. Cypress, fir, and oaks are rarely used. All timber cutting is selective, except in the few areas in which the forest is clear-felled and transformed into agricultural land. The primary source of white pine wood for the furniture industry are the areas above 2,500 meters in the municipio of San Miguel Totonicapán and, to a lesser extent, in Chiquimula. The cutting of white pine is the predominant nonagricultural economic activity in the cantones and parcialidades that have maintained communal forest holdings in the white pine areas; individuals from cantones that lack extensive communal forests may cut white pine only from the communal forests of the municipio. Forty years ago the forests of Totonicapán were an important source of white pine for the carpenters of Quezaltenango; in 1936 Felix Webster McBryde reported seeing twenty-five men from Totonicapán carrying white pine boards on their backs or on mules to Quezaltenango every day.¹² Now virtually no white pine lumber leaves Totonicapán except as finished products. The carpenters of San Cristóbal buy as much white pine from sources in San Marcos as they do from San Miguel Totonicapán, and the carpenters of Quezaltenango report that they no longer receive any white pine from Totonicapán.¹³

All of the tree species as well as large shrubs are used for firewood. In the case of the pines, the branches are systematically pruned to obtain firewood and thus the entire tree is often not felled. For the poorest sector of the population, the cutting and sale of firewood is often the major local source of cash income. Although firewood is consumed in a wide variety of activities, such as the baking and pottery industries and in the distillation of liquors, well over 90 percent of all firewood is consumed in

⁹ "Tenencia de la tierra y desarrollo socio-económico del sector agrícola en Guatemala" (Comité Interamericano de Desarrollo Agrícola, Guatemala City, 1971), pp. 195-200; "La tenencia de la tierra en las regiones indígenas," *Bol. Inst. Indigenista Nacional*, Vol. 1, 1957, pp. 69-78, reference on p. 75; and "Síntesis socio-económico del departamento de Totonicapán," *Guatemala indígena*, No. 10, 1964, pp. 43-92, reference on p. 75.

¹⁰ "Séptimo censo de población, 1964" (3 vols.; Dirección General de Estadística, Guatemala City, 1972), Vol. 2, p. 455; "Sexto censo de población, 1950" (Dirección General de Estadística, Guatemala City, 1953), p. 18; and Octavo censo [see footnote 5 above], p. 73. The intensity of land use in the western highlands of Guatemala has been described by Oscar H. Horst: *The Specter of Death in a Guatemalan Highland Community*, *Geogr. Rev.*, Vol. 57, 1967, pp. 151-167.

¹¹ Felix Webster McBryde: *Geografía cultural e histórica del suroeste de Guatemala* (2 vols.; Seminario de Integración Social Guatemalteco, Guatemala City, 1969), Vol. 1, pp. 73-74.

¹² McBryde, *op. cit.* [see footnote 11 above], Vol. 1, p. 205.

¹³ The carpenters of Quezaltenango are now supplied mostly from forests in the departments of San Marcos and Sololá and increasingly must buy imported lumber.

cooking and heating. Although almost all of the firewood consumed in Totonicapán is cut within the department, a small amount is also imported. This contrasts with the situation in the 1930's, when Totonicapán was an important source of firewood for surrounding departments.¹⁴

A common practice in Totonicapán involves the cutting of pines to obtain ocote for use as kindling and torches. These resinous splinters or chips are extracted primarily from *Pinus oocarpa* and *P. montezumae* by cutting a square 15 to 20 centimeters on a side and 5 to 10 centimeters deep into the trunk of the pine. This pattern of cutting is repeated until a long spiral wound is formed from less than 1 meter to more than 2 meters above the ground. A fire is frequently set at the base to increase the flow of resin into the wound.

Just as firewood consumption has increased with population growth during the past forty years, so has ocote consumption. Although electric lighting is now available in the cabeceras, rural areas still depend on kerosene lamps or on ocote, and ocote continues to be used in large quantities as a kindling and as an essential element in many esoteric religious ceremonies.

The collection of forest litter for use as fertilizer continues to be important, as does the cutting or pruning of fir and pine to obtain ornamental materials for both private and commercial use. Pine and fir boughs are used to decorate homes, churches, and marketplaces several times a year on religious holidays. Small firs are often felled in December for sale as Christmas trees in Guatemala City, although this practice is illegal and is decreasing in importance.

Other types of forest use have decreased or even disappeared over the past forty years. For example, charcoal, long preferred by the ladinos of Totonicapán as a cooking fuel because of its smokeless quality, has largely been replaced by kerosene or propane gas; only the poorest ladinos continue to use charcoal. In general, the use of plants as sources of tannins and dyes in Totonicapán has almost entirely disappeared with the increased use of synthetic tannins and aniline dyes.

Considering the increased intensity of utilization of the forest and the tremendous need for more agricultural land as the population has risen by 80 percent over the past forty years in Totonicapán, it is remarkable that any forest at all has been left standing. Partial aerial photographic coverage of Totonicapán is available for 1932, 1946, 1954, 1958, and 1972.¹⁵ Comparison of the earlier photographs with those of 1972 as well as with ground observations indicates a remarkably stable pattern of forest as opposed to grassland and cultivated land. The conversion of forest to agricultural use has been limited to the lower slopes of the Valley of Totonicapán, to the zone between San Bartolo and Momostenango, and to the area northeast of Momostenango and Santa María Chiquimula. The principal forested area along the María Tecún Ridge has remained largely intact: in the Totonicapán fifteen-minute quadrangle (primarily the Valley of Totonicapán and much of the continental divide to the north and east) the forested area declined by only 7 percent from 1954 to 1972. That this forest

¹⁴ McBryde, *op. cit.* [see footnote 11 above], Vol. 1, p. 220.

¹⁵ The 1954 and 1958 aerial photographs were obtained from the Instituto Geográfico Nacional, Guatemala City. The 1946 photographs are in the possession of Oscar H. Horst, Western Michigan University, and were originally obtained from the U.S. Army (Topographic Command, Project 2, Mission 2, Strip 216). The 1932 photographs were obtained from the Cartographic Archives Division of the U.S. National Archives, Washington, D.C. (Inter-American Highway Reconnaissance Surveys, Series 5). The 1972 photographs were studied in the Quezaltenango office of the Centro Técnico Forestal (now the Instituto Nacional Forestal).

preservation is restricted to Totonicapán is indicated by a comparison with the adjacent quadrangle to the east in the departments of Quiché and Sololá; here, the forested area decreased by more than 60 percent during the same period.¹⁶

Although only small areas of forest have been clear-felled in Totonicapán in recent years, the forest vegetation has clearly been much altered by man. The selective logging and extensive pruning over many years have altered the structure and the species composition of the pine-oak forests. The pruning of pines is so widespread in Totonicapán that the forest canopies are significantly opened up, thus permitting widespread regeneration of pines where light levels would otherwise be insufficient. The structure of the few pine-oak forests that have not been selectively logged or heavily pruned indicates that in the absence of such disturbances the more shade-tolerant oaks would slowly replace the pines. The cutting of small firs for Christmas trees and the destruction of seedlings by sheep have apparently reduced the importance of firs in the vegetative mosaic.¹⁷

If demographic and economic forces alone are considered, one would expect the period since the 1930's to have been a time of rapid forest clearing to make more land available for the "making of milpa." However, in seeking an explanation for the remarkable stability of the forest boundaries during this period more than just the twentieth-century demographic and economic pressures must be considered.

THE HISTORY OF RESOURCE USE IN TOTONICAPAN

The area which is today the department of Totonicapán may have been as populous in pre-Hispanic times as it was at mid-twentieth century.¹⁸ In pre-Hispanic times, in the absence of wheat, barley, and oats, maize dominated the agriculture of Totonicapán even more than it does today. Agricultural activity above 2,750 meters would have been considerably less than it is today. Although the well-known pre-Hispanic foodstuffs of highland Guatemala (maize, squashes, beans, and chili peppers) are all mentioned in native documents,¹⁹ the manner in which they were cultivated is not described; thus it is difficult to judge the intensity of pre-Hispanic agricultural activities. However, Pedro de Alvarado, the Spanish conqueror of Guatemala, stated that the land in the Valley of Quezaltenango (at the western end of the Valley of Totonicapán) was as intensively cultivated as that of Tlaxcala (central Mexico), which was famed for its intensive agriculture.²⁰

In addition to the absence of Old World grains, a major difference between pre-Hispanic and current agricultural technology involves the use of fertilizer. Today the Indian cultivator fertilizes his field with commercial chemical fertilizers, animal manure, human waste, lime, forest litter, and crop residue. Without the chemical fertilizers and animal manure the pre-Hispanic Quiché must have relied more heavily on forest litter and crop residue. Thus the pre-Hispanic collecting of leaves and

¹⁶ Luis Ferraté, Centro Técnico Forestal, personal communication, 1974.

¹⁷ William T. Brigham: Guatemala: The Land of the Quetzal (C. Scribner's Sons, New York, 1887), p. 137; and Paul C. Standley: Notes on Some Guatemalan Trees, *Tropical Woods*, Vol. 84, 1945, pp. 1-18, reference on p. 6.

¹⁸ Veblen, Native Population Decline [see footnote 5 above].

¹⁹ The native documents are the oral traditions that were written in the Quiché and Cakchiquel languages in the sixteenth century by Indians who had been taught the use of the Latin alphabet by Spanish missionaries.

²⁰ Pedro de Alvarado: Dos cartas de Pedro de Alvarado a Hernán Cortés, *Anales de la Sociedad de Geografía e Historia de Guatemala*, Vol. 19, 1944, pp. 386-396, reference on p. 387.

needles was probably an important use of the forest resource. On the other hand, the felling of trees for either fuel or construction material was probably less frequent in pre-Hispanic times. The pruning of branches was the most likely method of obtaining firewood in the absence of effective metal tools. The felling of trees for the construction of the typical Indian house also probably was of minor importance because the most common house type in the pre-Hispanic times was of adobe and grass.²¹ Today, the most common house type in Totonicapán is of adobe with a Spanish-style tile roof, which requires considerably more wood for the supporting lattice work than the grass roof. The difficulty of working the wood with primitive tools and the absence of any reports of houses constructed of logs in highland Guatemala suggest that the felling of large trees for construction material was not common in pre-Hispanic Totonicapán.

Native documents often mention the frequent use of ocote for kindling and torches and in religious ceremonies.²² They also mention the use of animal skins for clothing; consequently, it is likely that the bark of white pine was exploited as the source of tannin.²³ These documents refer to the use of bark for clothing, with alders being the most probable source.²⁴ A wide range of trees may have been subject to bark stripping for both tannin and dyes, just as they were until recent times. In short, the pre-Hispanic Quiché population valued the forests of Totonicapán primarily as a source of fuel and fertilizer and secondarily as a source of minor extractive products.

In the sixteenth century the native patterns of resource use were drastically modified by the Spaniards' introduction of new tools, new crops, and domesticated animals. Equally as significant were the changes that took place in the land tenure system. This century witnessed the evolution of the institutions that even today, in large part, govern the exploitation of the land in Totonicapán. Furthermore, the imposition of the Spanish tribute system played an important role in the evolution of the colonial landscapes of Totonicapán.

Most of the tools, livestock, and cultivated plants with which the Spaniards were familiar in Europe were introduced to Guatemala in the late 1520's and early 1530's and probably reached Totonicapán very soon thereafter. This was the time of the introduction of metal axes, machetes, and hoes. Wheat, rye, oats, and barley reached Guatemala during the first decade of Spanish domination, and by 1530 sheep, cattle, and horses were reproducing in large numbers.²⁵ In fact, the first report from Guatemala of cattle being a menace because of their habit of invading and destroying milpas dates from 1527.²⁶ By the last decades of the sixteenth century essentially the full range of European livestock and crops were present in Totonicapán.²⁷

²¹ Alonso de Ponce: Relación breve y verdadera de algunas cosas de las muchas que sucedieron al Padre Fray Alonso Ponce en las provincias de la Nueva España, *Colección de Documentos Inéditos para la Historia de España* (112 vols.; Viuda de Calero, Madrid, 1872), Vol. 1, p. 385.

²² Adrián Recinos (trans.): Popol Vuh: The Sacred Book of the Ancient Maya (Univ. of Oklahoma Press, Norman, 1950), pp. 115-117.

²³ *Ibid.*, p. 176.

²⁴ Adrián Recinos (trans.): The Annals of the Cakchiquels: Title of the Lords of Totonicapán (Univ. of Oklahoma Press, Norman, 1953), p. 82.

²⁵ Francisco Vázquez: Crónica de la Provincia del Santísimo Nombre de Jesús de Guatemala *Biblioteca Goathemala*, Vols. 14-17, (Sociedad de Geografía e Historia, Guatemala City, 1937), Vol. 14, pp. 156-159.

²⁶ Rafael de Arévalo, edit.: Libro de actas del ayuntamiento de la Ciudad de Santiago de Guatemala, desde la fundación de la misma ciudad en 1524 hasta 1530 (Imprenta La Luna, Guatemala City, 1932), pp. 40 and 150.

²⁷ Juan de Pineda: Descripción de la Provincia de Guatemala, año de 1594, *Colección de libros y documentos referentes a la historia de América* (V. Suárez, Madrid, 1908), Vol. 8, pp. 434-435.

An important determinant of land use in early colonial Guatemala was the extent of Spanish settlement in a given area. In the first half of the sixteenth century the Spaniards settled only near major urban administrative centers such as Santiago Guatemala (Ciudad Vieja, near modern Antigua) and in areas that were sources of quick wealth, such as the cacao-producing Pacific piedmont. In the absence of gold and silver, the most attractive source of wealth in Totonicapán was its large Indian population, which could have been used as labor on the cacao plantations. However, there was no need to transport highland Indians to the tropical lowlands until the mid-sixteenth century, when the coastal population had almost disappeared owing to introduced diseases.

From 1524 to 1541 Totonicapán was part of Alvarado's huge but loosely administered grant (*encomienda*) of Indian labor and tribute, and no significant Spanish settlement took place in Totonicapán until the 1540's.²⁸ After Alvarado died, his *encomienda* reverted to the Spanish crown, which, while retaining most of it as royal land, granted smaller *encomiendas* to a few of the original conquistadores. A large *encomienda* in the Valley of Totonicapán was granted to one of Alvarado's former lieutenants, Juan de León Cardena, who derived considerable wealth from forcing the Indians to raise sheep.²⁹ Thus, in terms of pressure on the land, in the Valley of Totonicapán growing numbers of sheep at least partially replaced the diminished cultivation of the land in the mid-sixteenth century.

Little is known about the nature of pre-Hispanic land tenure systems in Totonicapán because of the drastic disruptions of native society that occurred between 1524 and 1541. In Guatemala the *reducción*, or concentration of the small dispersed settlements into larger towns, was first ordered by the crown in 1540, and in the following decade the colonial system of land tenure in Totonicapán began to take shape.³⁰ The gathering of the native population was intended to aid the Spanish officials in the civil administration of the Indians (especially in tribute collection) and to ease the missionaries' task of instructing them in Christianity. In highland Guatemala, as in other places, missionaries had the leaders of small hamlets inspect and approve the site selected for the new town. Milpas would then be cleared and planted around the site, and while the maize was maturing the population would be put to work constructing the church and administrative buildings.³¹ Although many towns in Guatemala were created by the *reducción* process, many others had been important pre-Hispanic settlement sites and were simply taken over by the Spaniards.³²

²⁸ Peter Gerhard: Colonial New Spain, 1519-1786: Historical Notes on the Evolution of Minor Political Jurisdictions, *Handbook of Middle American Indians* (edited by Howard F. Cline; Univ. of Texas Press, Austin, 1972), Vol. 12, pp. 63-137, reference on p. 132; William L. Sherman: A Conqueror's Wealth: Notes on the Estate of Don Pedro de Alvarado, *The Americas*, Vol. 26, 1969, pp. 202 and 212-213; and Pedro P. Valenzuela: Una frase de Bernal Díaz del Castillo: Las deudas del adelantado, *Anales de la Sociedad de Geografía e Historia de Guatemala*, Vol. 17, 1941, pp. 280-296, reference on p. 291.

²⁹ "Diccionario Geográfico de Guatemala" (2 vols.; Dirección General de Cartografía, Guatemala City, 1962), Vol. 2, p. 344.

³⁰ José Joaquín Pardo: Índice de documentos existentes en el Archivo General de Guatemala (Archivo General del Gobierno, Guatemala City, 1947), p. 131.

³¹ Antonio de Remesal: Historia general de las Indias occidentales y particular de la gobernación de Chiapa y Guatemala, *Biblioteca Geohemala*, Vols. 4-5 (Sociedad de Geografía e Historia, Guatemala City, 1932), Vol. 5, pp. 245-246.

³² For example, San Miguel Totonicapán, Chiquimula, and Momostenango were all important pre-Hispanic settlements (Recinos, *Popol Vuh* [see footnote 22 above], p. 29; and Robert M. Carmack: Quichean Civilization: The Ethnohistoric, Ethnographic, and Archeological Sources (Univ. of California Press, Berkeley and Los Angeles, 1973), pp. 363-366.

The reducción process is significant because it legitimized the communal lands of the Indian towns and villages. Each newly created town was supposed to have an *ejido*, or area of uncultivated land, that could be used by all members of the community for pasturing livestock, cutting firewood, hunting, and collecting various forest products.³³ Thus, by law each new town was given an area of communal lands. However, the smaller groups which were brought together in the reducción process maintained their identities as parcialidades and continued to exert control over the lands of their former village sites.³⁴ Where the reducción process was not successful, the parcialidades returned to their former sites, which often eventually became cantones or aldeas within the municipio. In this way, a complex pattern of communal lands has evolved in which one ejido is open to all citizens of the municipio, other ejidos exist for each village, and still others belong to parcialidades or to different neighborhoods within the cabecera of the municipio.

Not until the seventeenth century did Spaniards and ladinos begin to settle in Totonicapán in significant numbers. This settlement was part of the flight from expensive urban life in colonial Guatemala brought on by the collapse of the cacao boom and the severe economic depression of the seventeenth century.³⁵ Because of its attractiveness for wheat growing and its location along the principal land route between Mexico and Guatemala, the Valley of Totonicapán became the focus of the Spanish and ladino settlement within the department. Uncultivated ejido lands belonging to San Miguel Totonicapán and San Cristóbal became the prime targets of the new settlers, and usurpation of these lands resulted in much litigation.³⁶ Although the Indians were largely successful in protecting their communal lands from newly arrived Spaniards, the sudden increase in the demand for land initiated a chain reaction of encroachments by Indian settlements onto the communal lands of their neighbors. The resulting land disputes produced not only occasional violent conflicts but also a series of legal cases involving two or more Indian communities that continued throughout the colonial period and, in some cases, have not yet been resolved.³⁷

Although the seventeenth century was a time of extremely slow recovery of the native population in the western highlands of Guatemala, it was a period of relative economic prosperity in Totonicapán. The depression of the export-import economy and the move of the Spanish elite to the countryside spurred the development of agriculture and artisanry in the rural areas. By the 1620's Totonicapán had become famous for its production of maize, wheat, sheep, and hogs, and it produced so many apples that they were fed to the hogs.³⁸ The forests of Totonicapán, which were claimed to be good for the hunting of deer, rabbits, and birds, became heavily exploited during the seventeenth century. In addition to white pine, fir is specifically

³³ Remesal, *op. cit.* [see footnote 31 above], Vol. 5, pp. 245-246; and Lesley Byrd Simpson: Studies in the Administration of the Indians in New Spain, *Ibero-Americana*, Vol. 7, 1934, pp. 29-129, reference on p. 44.

³⁴ Antonio Batres Jáuregui: Los indios, su historia y su civilización (Tipografía La Unión, Guatemala City, 1894), pp. 113-114.

³⁵ Murdo J. MacLeod: Spanish Central America: A Socioeconomic History, 1520-1720 (Univ. of California Press, Berkeley, 1973), pp. 217-220.

³⁶ See, for example, 1648 document, Archivo de Centroamérica, Guatemala City, A1, expediente 51988, legajo 5941; and 1664 document, Archivo de Centroamérica, Guatemala City, A1, expediente 53386, legajo 6047.

³⁷ See, for example, 1633 document, Archivo de Centroamérica, Guatemala City, A1, expediente 51980, legajo 5941; and 1699 document, Archivo de Centroamérica, Guatemala City, A1, expediente 52168, legajo 5956.

³⁸ Antonio Vázquez de Espinosa: Compendium and Description of the West Indies, *Smithsonian Inst. Misc. Colls.*, Vol. 102, 1942, p. 223.

noted as being an abundant and valuable tree of these forests.³⁹ The large number of carpenters reported for San Miguel Totonicapán clearly indicates that the furniture industry was well established by the late seventeenth century.⁴⁰ A wide variety of wood products, including the small chairs of white pine that are so ubiquitous today in Guatemala, are listed in the seventeenth-century economic descriptions of Totonicapán.⁴¹

Seventeenth- and eighteenth-century accounts of land use in Totonicapán describe a pattern that is remarkably similar to that of today. By the time of the 1740 "Relación geográfica," sheep raising and milpa production were important in all of the towns in the *partido* of Totonicapán (approximately equivalent to the present-day department). The towns in the Valley of Totonicapán were also noted for their wheat production. In the northeastern half of Totonicapán sheep, not wheat, provided the major source of cash income.⁴² By the latter part of the eighteenth century, the *partido* of Totonicapán had become one of the most important wheat- and wool-producing areas in Central America.⁴³ Toward the end of the colonial period, however, there is substantial evidence that economic growth and the partial revival of the native population had resulted in considerable pressure on the land. Rarely did a year pass in the late eighteenth century when an Indian village did not charge that citizens of another village had encroached on its communal lands.⁴⁴

As early as 1778 the Indians of Chiquimula found it necessary to rent lands from the neighboring villages on the northeast border of the department of Totonicapán.⁴⁵ In order to meet the rental fees the Indians of Chiquimula began paying tribute in the form of personal service, goods, and cash to the inhabitants of the other villages. The resentment produced by this feudal relationship eventually led to a bloody massacre late in the eighteenth century.⁴⁶ Considerable pressure on the land resource is also indicated for San Francisco when, in the 1790's, the inhabitants of this town were forced to travel to areas outside of Totonicapán to find sufficient pasture for their 3,000 head of sheep.⁴⁷

It is evident that at the end of the colonial period, a population of only 30,000 to 40,000 in the *partido* of Totonicapán found the land resource insufficient to support itself. This is somewhat puzzling, for the population at the time of the Spanish Conquest was probably at least twice the size of the population in 1821 and the same

³⁹ Francisco Fuentes y Guzmán: Recordación flórica: Discurso historial y demostración natural, material, militar, y política del Reyno de Guatemala (2nd edit.), *Biblioteca Goathemala*, Vols. 6-8 (Sociedad de Geografía e Historia de Guatemala, Guatemala City, 1933), Vol. 8, pp. 44-45.

⁴⁰ Vázquez, *op. cit.* [see footnote 25 above], Vol. 17, pp. 48 and 439.

⁴¹ Fuentes y Guzmán, *op. cit.* [see footnote 39 above], Vol. 8, pp. 45 and 52.

⁴² "Relación geográfica del partido de Huehuetenango," *Bol. Archivo General del Gobierno*, Vol. 1, 1935, pp. 23-24; Fuentes y Guzmán, *op. cit.* [see footnote 39 above], Vol. 8, p. 54; and Vázquez, *op. cit.* [see footnote 25 above], Vol. 17, pp. 51 and 350.

⁴³ 1779 document, Real Academia de Historia, Madrid, Mata Linares Collection, Vol. 1, pp. 220-246 (copy in the Dept. of Geography, Univ. of California, Berkeley).

⁴⁴ See, for example, 1775 document, Archivo de Centroamérica, Guatemala City, A1, expediente 55464, legajo 6096; 1807 document, Archivo de Centroamérica, Guatemala City, A1, expediente 27307, legajo 2923; and J. Daniel Contreras: Una rebelión indígena en el Partido de Totonicapán en 1820 (Imprenta Universitaria, Guatemala City, 1968), p. 34.

⁴⁵ Valentín Solórzano Fernández: Historia de evolución económica de Guatemala (Univ. Nac. Autónoma de México, Mexico City, 1947), pp. 234-236.

⁴⁶ M. García Elgueta: Etimología de los nombres de Totonicapán y Momostenango, *Anales de la Sociedad de Geografía e Historia de Guatemala*, Vol. 15, 1938, pp. 504-508, reference on p. 507.

⁴⁷ "Gazeta de Guatemala" (Guatemala City, 1797), p. 249.

area today has a population of approximately 167,000.⁴⁸ Two factors explain the apparent paradox: the introduction of livestock had decreased the human carrying capacity of the land; and Totonicapán has never been a closed system in terms of foodstuffs and other products of the land. The sixteenth-century reduction of the native population was probably more than counterbalanced by the growth of the sheep population in the seventeenth and eighteenth centuries. Raised primarily for their wool and rarely eaten, the sheep vastly reduced the amount of foodstuffs that could be produced on a given unit of land in Totonicapán. More important, it is likely that the sheep, as well as the other livestock, were responsible for the severe erosion which today continues to plague the northeastern half of the department. Pressure on the land in late colonial Totonicapán also reflected external demands. The pre-Hispanic influx of tribute goods to the Quiché of Totonicapán was abruptly reversed by the imposition of the Spanish tribute system in the sixteenth century. The most important tribute item demanded from the Indians of Totonicapán throughout the colonial period was the *mantla*, or woolen textile.⁴⁹ Consequently, large areas of land were required for sheep pasture in order to satisfy the tribute demands. Similarly, wheat, maize, and chickens were also paid as tribute or were used as a means of generating an income to meet tribute demands for cash and to pay the tithe demanded by the church. These items were consumed primarily by Spaniards or ladinos living outside the department of Totonicapán, and, therefore, pressure on the land included both the needs of the local population and the demands of an external population.

As the need for foodstuffs became greater than the supply within Totonicapán, sources outside the department were sought. The rental of lands by the inhabitants of Chiquimula was one solution; but that option was not feasible in the southwestern part of the department, which was bounded on all sides by densely settled regions. In the absence of land onto which they could expand their agricultural activities, the primary strategy employed by most of the villages of Totonicapán was to develop a trade with external areas to generate the income required for the importation of needed foodstuffs. In large part, this was the stimulus for the development of the cottage industries of most of the towns of Totonicapán. By the end of the colonial period, San Miguel Totonicapán and San Cristóbal had become the most important furniture and pottery-making centers, and Momostenango the most important center of woolen textiles, in Guatemala. Chiquimula apparently was under the greatest population pressure, for its inhabitants traveled as far as the Pacific Coast and central eastern Guatemala to trade ocote for the foodstuffs grown in the lowlands.⁵⁰ The inhabitants of the entire department of Totonicapán had gained a reputation as industrious merchants, and their products were traded throughout Guatemala. This stands in considerable contrast with areas such as the Cuchumatanes Mountains, where the population had the option of extending their agricultural activities into the surrounding unoccupied lands at lower altitudes and, consequently, remained isolated and self-sufficient throughout the colonial period.

Early in the colonial period the Indians of Totonicapán had evolved institutions

⁴⁸ Veblen, *Native Population Decline* [see footnote 5 above].

⁴⁹ 1655 document, Archivo de Centroamérica, Guatemala City, A1, *expediente* 10205, *legajo* 1561; and 1768 document, Archivo de Centroamérica, Guatemala City, A3, *expediente* 10261, *legajo* 501.

⁵⁰ Domingo Juarros: *A Statistical and Commercial History of the Kingdom of Guatemala in Spanish America* (J. Hearne, London, 1823), p. 78; and *Gazeta de Guatemala* [see footnote 47 above], pp. 249 and 257.

that allowed them to meet the demands of the Spaniards and ladinos without losing control of the means of production (that is, the land). The most important of these protective institutions was the ejido. During the sixteenth century the communal lands of each town, village, and parcialidad had been carefully delimited. Consequently, when Spaniards and ladinos attempted to encroach on an ejido, they had to contend with the population of an entire settlement, not just with a single landowner. Similarly, the communal forest system also made it more difficult for a citizen of the town in possession of that ejido to clear the forest and plant crops. Although the members of each settlement had the right to graze their animals and cut wood on communal lands, the ejidos could not be used for planting crops. This pattern continued into the republican period and was reinforced both by municipal laws and by the national forest conservation law of 1892, which prohibited the clearing of communal forest land to create agricultural land.⁶¹ Clearly, these laws were not as effective elsewhere in Guatemala as they were in Totonicapán. One factor in their success was the recognition of the commercial value of the forests that resulted from the early establishment of the furniture industry in Totonicapán. The large number of carpenters in the department, especially in San Miguel Totonicapán, had a vested interest in preserving their source of raw materials and exerted considerable influence on the municipal government regarding forest use.

Another institution which has tended to protect the Indian society from the encroachment of the Spaniards and ladinos is the administrative system in which the municipio is virtually autonomous.⁶² Strictly speaking, the municipio system of government did not exist until the republican era; however, the towns of the colonial period are almost identical to the present-day municipios. In the colonial period, the basic unit of the pre-Hispanic social organization was the parcialidad; and today the principal legal rights of members of a parcialidad include the rights to graze their animals and to collect and cut wood in the communal forest belonging to that parcialidad. In fact, communal forest land is the only symbol of the existence of those parcialidades that do not constitute separate settlements. Although the use of communal forests is slightly restricted by the national forestry law and by municipal taxes, the exploitation and supervision of the communal forest is primarily in the hands of the elders of the parcialidad. Each parcialidad today, as was probably true in the colonial period, elects forest inspectors to assure that only the people of their parcialidad or village use the forest and to generally protect the communal forest against encroachment by agricultural activities. Thus the parcialidad has become an appropriate and effective social unit for the administration of the ejido.

Another fortuitous circumstance that aided the native population in its attempt to maintain control over the land resource was the relatively minor importance of the encomienda system in Totonicapán. After the death of Alvarado a few small encomiendas were granted in Totonicapán, but most of the area remained directly in the

⁶¹ "Recopilación de las leyes de la República de Guatemala" (Tipografía Nacional, Guatemala City, 1894), pp. 41-42 and 231.

⁶² The semiautonomy of the municipio is partially a result of the late sixteenth-century attempt by the Spanish crown to isolate the Indian population (for its own protection) from the non-Indian population. The segregationist legislation prohibited non-Indians from remaining in an Indian town for more than three consecutive days and forbade non-Indians from participating in Indian *cabildos* and from acquiring Indian land. In most of colonial Spanish America the segregationist laws were rarely enforced, but owing to the natural aversion of the Maya to foreigners, legal theory became a reality in much of western Guatemala (Magnus Morner: *La política de segregación y el mestizaje en la Audiencia de Guatemala*, *Revista de Indias*, Vol. 24, 1964, pp. 137-151).

hands of royal authorities.⁵³ Although an *encomienda* grant only involved the rights to labor and tribute from the Indian population, the *encomendero* tended, legally or illegally, to acquire land and, in some cases, to settle near the native population in his charge. The lack of importance of the *encomienda* system, and thus the lack of Spanish *encomenderos* seeking land, may have spared the Indians of Totonicapán some encroachment on their lands.

The patterns of settlement and land tenure that evolved in the early colonial period were not significantly modified by the military and political upheavals associated with the achievement of independence from Spain in the first half of the nineteenth century. The tribute system, however, was terminated. Totonicapán remained an area of overwhelmingly Indian population, and each settlement continued to have its *ejido* or communal forest. The relatively rapid population growth of the nineteenth century continued to exacerbate the old disputes over territorial boundaries and rights to communal lands. Again, the towns of Momostenango and Chiquimula seem to have suffered the most from insufficient lands during this period. The Indians of Chiquimula fought their neighbors in the *municipios* of the department of Quiché over land several times.⁵⁴ The need for more land for milpa and pasture forced substantial numbers of Indians from Chiquimula and Momostenango to migrate to the southwest coast and to the Cuchumatanes Mountains during the nineteenth century.⁵⁵

The fact that the Indians of Momostenango and Chiquimula were forced to seek new lands outside the department in the nineteenth century is a reflection not only of population growth but perhaps also of a decreasing carrying capacity of their own lands. Until the nineteenth century, these two *municipios* were highly regarded for the productivity of the milpas and for the large numbers of sheep raised.⁵⁶ However, in the latter part of the nineteenth century badlands topography, *los riscos*, began to be mentioned in the descriptive accounts of Momostenango.⁵⁷ By the early part of the twentieth century Momostenango had become less dependent on agricultural activities and more dependent on artisanry than any other Indian town in Guatemala. The entire northeastern third of the department of Totonicapán and the southwestern part of the department of Quiché had become the most seriously eroded and sterile region of the country.⁵⁸ This condition contrasted sharply with Alvarado's description of the great productivity in the region at the time of the Conquest. It is likely that the excessive erosion and exposure of hardpan here resulted from overgrazing by sheep during the seventeenth and eighteenth centuries.

CONCLUSIONS

Since pre-Hispanic days Totonicapán has been an area of dense settlement and of intense agricultural activity and forest exploitation; yet today it is the site of the most extensive pine forests remaining in the volcanic highlands of Guatemala. The 80 percent increase in population that has occurred in the last third of a century makes

⁵³ Valenzuela, *op. cit.* [see footnote 28 above], p. 291.

⁵⁴ García Elgueta, *op. cit.* [see footnote 46 above], p. 507.

⁵⁵ McBryde, *op. cit.* [see footnote 11 above], p. 272; and Franz Termer: *Etnología y etnografía de Guatemala* (Seminario de Integración Social Guatemalteco, Guatemala City, 1957), p. 52.

⁵⁶ Vázquez, *op. cit.* [see footnote 25 above], Vol. 17, pp. 51 and 330; and *Relación geográfica* [see footnote 42 above], p. 24.

⁵⁷ García Elgueta, *op. cit.* [see footnote 46 above], pp. 504-505.

⁵⁸ McBryde, *op. cit.* [see footnote 11 above], p. 67.

the persistence of these forests even more remarkable. The forests of Totonicapán cannot be considered to occur above the upper limits of cultivation because corn is grown in this region as high as 3,100 meters and potatoes, wheat, and oats are found at even higher altitudes. Furthermore, the higher altitudes in Totonicapán could have been cleared to make sheep pasture as has occurred in much of the Cuchumatanes at altitudes of 2,800 to 3,200 meters.

The cultural factors that account for the preservation of the forests of Totonicapán have their roots in the pre-Hispanic past as well as in the sixteenth-century period of cultural syncretism. The response of the Indians of Totonicapán to the demands and pressures that were imposed on them in the sixteenth century was critical in the evolution of the pattern of resource exploitation. For example, the economic value of the white pine forests was recognized early and became the basis of the furniture industry that has been unique to Totonicapán for well over four centuries. Why the industry developed here but not in other areas with abundant white pine supplies is not easily determined. However, the development of cottage industries, such as furniture making and weaving, was due in large part to the fact that Totonicapán has long been surrounded by densely settled areas which prevented the expansion of agricultural activities to meet the needs of its growing population. Similarly, the need to pay tribute in the form of cash in the sixteenth century and the desire to avoid working on the cacao plantations of the coast (the primary alternative means of earning a wage at the time) were probably important factors in the early rise of carpentry and other crafts in Totonicapán.⁵⁹ This early recognition of the economic value of the white pine forest and the gradual increase in the number of carpenters dependent on it for raw materials undoubtedly contributed to a more conservative pattern of forest use than anywhere else in highland Guatemala.

Similarly, the institution of communal forest holdings has favored preservation of the forests of Totonicapán. Although communal forests are not unique to Totonicapán, they have provided an effective means of controlling forest use. Each municipio, cantón, and parcialidad that maintains a communal forest is responsible for supervising the use of its forest and for interpreting those parts of the national forestry law it wishes to enforce; much encroachment on the forests is prevented by this vigilance. Whereas forest land that is privately owned can easily be cleared to provide more land for milpa, the members of communities who depend on the income generated from woodcutting and carpentry have effectively prevented the clearing of their communal forests.⁶⁰

The case of forest preservation in Totonicapán has some general implications with regard to communal ownership of natural resources. The proponents of the "tragedy of the commons" hypothesis suggest that where environmental goods are communally owned there is a tendency for such goods to be overused as a consequence of the resource users' attempts to maximize their utility.⁶¹ Ultimately such overuse will

⁵⁹ In the middle and late sixteenth century, tribute was demanded either in the form of cash or as goods that could be easily transformed into cash. Indians were forced to seek employment on the cacao plantations of the Pacific piedmont and thus alleviate the labor shortage there (MacLeod, *op. cit.* [see footnote 35 above], p. 129).

⁶⁰ During the late sixteenth and early seventeenth centuries, when the furniture industry became established, Indians were in need of a source of cash for tribute payment rather than of more land for food production. Not until the late seventeenth or eighteenth centuries did land for agricultural pursuits become scarce, and by that time a large number of timber cutters and carpenters already had a vested interest in the continued productivity of their forests.

⁶¹ Garrett Hardin: *The Tragedy of the Commons*, *Science*, Vol. 162, 1968, pp. 1243-1248.

destroy the resource. That this has not occurred in the communal forests of Totonicapán is due to several factors. First, interpersonal relationships are face-to-face in Totonicapán. Totonicapeños generally recognize one another, if not individually, at least by family or *parcialidad*. The absence of anonymity contributes to the respect for the established communal forest boundaries. Second, a powerful special interest group—the carpenters—is well aware that it lacks alternative sources of raw materials should the forests of Totonicapán be transformed into pasture or agricultural land. They encourage the Indian community to maintain close vigilance over the use of the communal forests and to punish those who cut wood illegally. Third, the Indian population of Totonicapán has a strong desire to remain as independent of outside influence and control as possible.⁶² This desire for self-sufficiency encourages the maintenance of traditional patterns of resource exploitation.

⁶² Morris Siegel: Resistance to Culture Change in Western Guatemala, *Sociology and Social Research*, Vol. 25, 1941, pp. 414-430.

RURAL REVOLUTION IN EAST CAROLINA*

JOHN FRASER HART and ENNIS L. CHESTANG

TOBACCO is the nation's fifth most important cash crop, after corn, soybeans, wheat, and cotton. In 1976 the crop placed a billion dollars in the pockets of farmers in North Carolina, and half a billion in the pockets of Kentucky farmers; it accounted for approximately half of the total farm income in each state. In that same year the United States exported almost a billion dollars' worth of tobacco leaf and almost half a billion dollars' worth of manufactured tobacco products, mainly through the ports of Norfolk, Virginia, and Wilmington, North Carolina.¹

Tobacco has been one of the last major field crops in the United States to be mechanized. Even after World War II, in fact, observers still wondered whether machines could ever perform some of the delicate tasks required in producing the crop.² Within the past quarter-century, however, the production of flue-cured tobacco (which is concentrated in Virginia, the Carolinas, and Georgia) has become increasingly mechanized, although the mechanization of the crop is still far from complete. Much hand labor still is needed in certain stages of production, and some farmers have adopted the new techniques and equipment less enthusiastically than their neighbors.

The mechanization of flue-cured tobacco production, late and spasmodic though it has been, has nevertheless wrought a rural revolution in the producing districts, where the contemporary countryside is an odd blend of the past and the future, reflecting the changes that are taking place. Tens of thousands of tired old cube-shaped flue-cured tobacco barns still dot the land, but they have been superseded by shiny new metal bulk-curing barns. Field layouts have been modified to accommodate the new machines. Farmers have been obliged to cultivate larger acreages in order to use these machines efficiently. The land available for sale or rent has been scattered at ever greater distances from their original farmsteads, and some have succumbed to the temptation to move into nearby towns and become "sidewalk farmers" when their former farmsteads are no longer central to their farm operations.

The traditional techniques of flue-cured tobacco production required large numbers of farm workers, mostly black people, but farm mechanization has not triggered a massive out-migration of displaced farm workers. The availability of a large labor force, emacipated from the land by the new farm machines, has attracted many new factories to the tobacco districts, and eastern North Carolina has made the transition from an agricultural to a mixed economy, a transition to which so many of the lesser-

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¹ These data on the importance of tobacco to the economy are taken from "Tobacco Industry Profile: 1977" (Tobacco Institute, 1776 K Street, NW, Washington, D.C. 20006).

² As late as 1960 the director of the Tobacco Division of the Agricultural Marketing Service of the U.S. Department of Agriculture was able to write: "While mechanization is not just around the corner, steady progress is being made. . . . Mechanization is urgently needed. It takes anywhere from 300 to 500 man-hours to produce an acre of tobacco" (Stephen E. Warther: Progress Reported in Drive to Mechanize Tobacco Growing, Cut Costly Hand Labor, *Tobacco News*, December, 1960, p. 1).

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developed countries of the 'Third World' aspire, within less than a single human generation.³

EASTERN NORTH CAROLINA

Flue-cured tobacco was first produced on small farms in the Piedmont area of Virginia and North Carolina, and in some circles it is still called "Virginia" tobacco.⁴

TABLE I—MAN-HOURS REQUIRED TO PRODUCE ONE ACRE OF SPECIFIED CROPS IN PERIODS INDICATED

CROP	1910-1914	1930-1934	1940-1944	1950-1954	1960-1963
Wheat	15.2	9.4	7.5	4.6	2.9
Soybeans	—	12.9	10.4	5.7	5.0
Corn for grain	35.2	28.2	25.5	13.3	7.0
Cotton	116	97	99	66	48
Tobacco	336	370	442	464	488

Source: McElroy, Hecht, and Gavett, *op. cit.* [see text footnote 5].

Many cotton farmers in eastern North Carolina shifted to tobacco when cotton prices dropped disastrously in the late 1880's. They retained the traditional tenancy system and grew the crop on a large scale with black sharecroppers. Flue-cured tobacco production migrated southward into South Carolina, Georgia, and northern Florida in the wake of boll weevil depredations in the late 1910's, but eastern North Carolina has retained its supremacy as the nation's leading producing district. Since the end of World War II the seven counties of State Economic Area 8 have regularly accounted for more than a sixth of the nation's flue-cured tobacco acreage, and the rural revolution wrought by the mechanization of the crop is most vividly manifest in this area (Figs. 1 and 2). The core area in eastern North Carolina is neatly framed by seven market towns with cavernous sales warehouses in which roughly a quarter of the nation's flue-cured tobacco crop is sold at auction each year (Fig. 3).

The tobacco districts of eastern North Carolina have had the densest rural farm population in the United States, because traditional techniques of producing flue-cured tobacco have necessitated more labor—most of it hand labor—than any other major field crop. Unlike other crops, whose labor requirements were cut by more than half by mechanization after World War II, the labor needs of flue-cured tobacco

³ For example, in only two decades the agricultural labor force in the seven counties of State Economic Area 8 in eastern North Carolina dropped by two-thirds, from 51,774 persons in 1950 to only 17,720 persons in 1970, but the manufacturing labor force nearly tripled, soaring from 13,091 persons in 1950 to 34,303 persons in 1970 ("Census of Population: 1950. Vol. II Characteristics of the Population. Part 33, North Carolina" [Bur. of the Census, Washington, D.C.], Table 43; and "Census of Population: 1970. Vol. I, Characteristics of the Population. Part 35, North Carolina" [Bur. of the Census, Washington, D.C.], Tables 121 and 123).

State Economic Area 8 includes Edgecombe, Green, Lenoir, Pitt, Nash, Wayne, and Wilson counties (Donald J. Bogue and Calvin L. Beale: *Economic Areas of the United States* [The Free Press of Glencoe, Inc., New York, 1961], pp. 497 and 894). This area is one of the few parts of the South that qualified as a real farming area (one with at least one farm per square mile that had sales of \$10,000 or more) in 1964 (John Fraser Hart: *A Map of the Agricultural Implosion*, *Proc. Assn. of Amer. Geogr.*, Vol. 2, 1970, pp. 68-71, map on p. 69), and it has remained one of the principal concentrations of cropland in the region (John Fraser Hart: *Cropland Concentrations in the South*, *Annals Assn. of Amer. Geogr.*, in press).

⁴ The evolution and nature of flue-cured tobacco production, as it was in 1958, are described in some detail in John Fraser Hart and Eugene Cotton Mather: *The Character of Tobacco Barns and Their Role in the Tobacco Economy of the United States*, *Annals Assn. of Amer. Geogr.*, Vol. 51, 1961, pp. 274-293, reference on pp. 288-293.

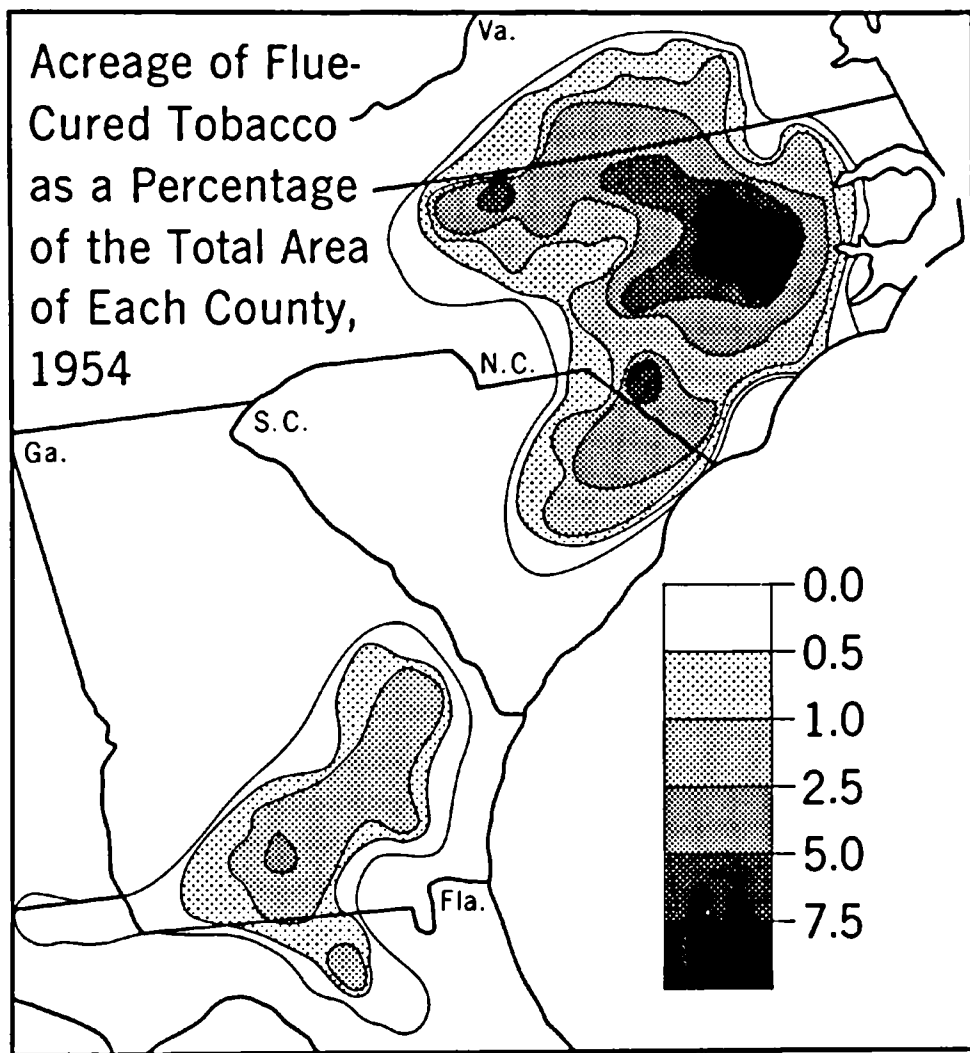


FIG. 1

increased as yields per acre increased, because the crop was harvested by hand, and more hands were needed to pick the larger crops. Producing a crop of flue-cured tobacco by man and mule in the early 1950's required approximately 450 man-hours per acre, as compared with 65 for cotton, 13 for corn, and 5 for soybeans and wheat (Table I). The labor requirements of flue-cured tobacco were concentrated in brief flurries of feverish activity. Transplanting in late March or early April required 20 man-hours per acre.⁸ Topping and suckering in late May and early June demanded

⁸ Estimates of the number of man-hours required for the various operations necessary to produce a crop of flue-cured tobacco are based on Robert C. McElroy, Reuben W. Hecht, and Earle E. Gavett: Labor Used to Produce Field Crops: Estimates by States, *Stat. Bull. No. 346*, U.S. Dept. of Agriculture, Washington, D.C., 1964, pp. 5 and 6; "Potential Mechanization in the Flue-Cured Tobacco Industry, With Emphasis on Human Resource Adjustment," *Agric. Econ. Rept. No. 169*, U.S. Dept. of Agriculture, Econ. Research Service, Washington, D.C., 1969, p. 24; J. Gwyn Sutherland: Minimum Land Requirement to Produce \$5,000 Net Farm Income, Eastern Piedmont and Upper Coastal Plain (Economic Areas Six and

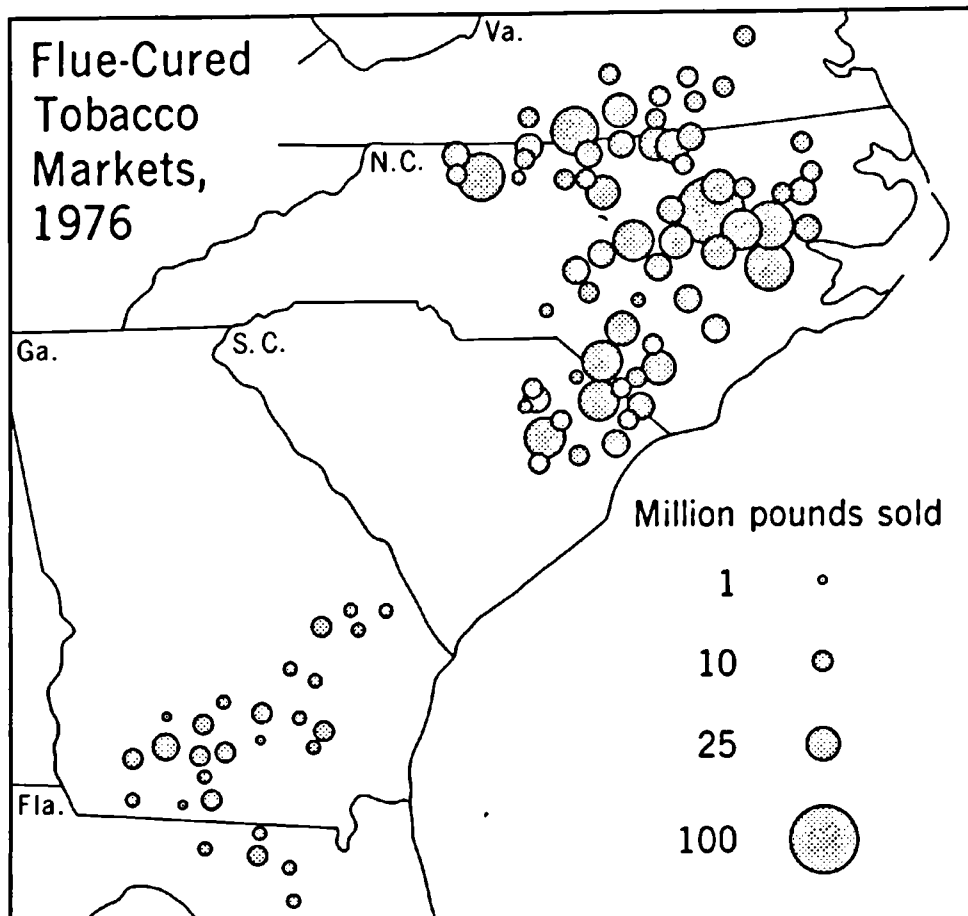


FIG. 2

another 30. Harvesting and curing the crop in July and August required about 350 man-hours per acre, and getting it ready for market in September another 50.

TRADITIONAL TECHNIQUES

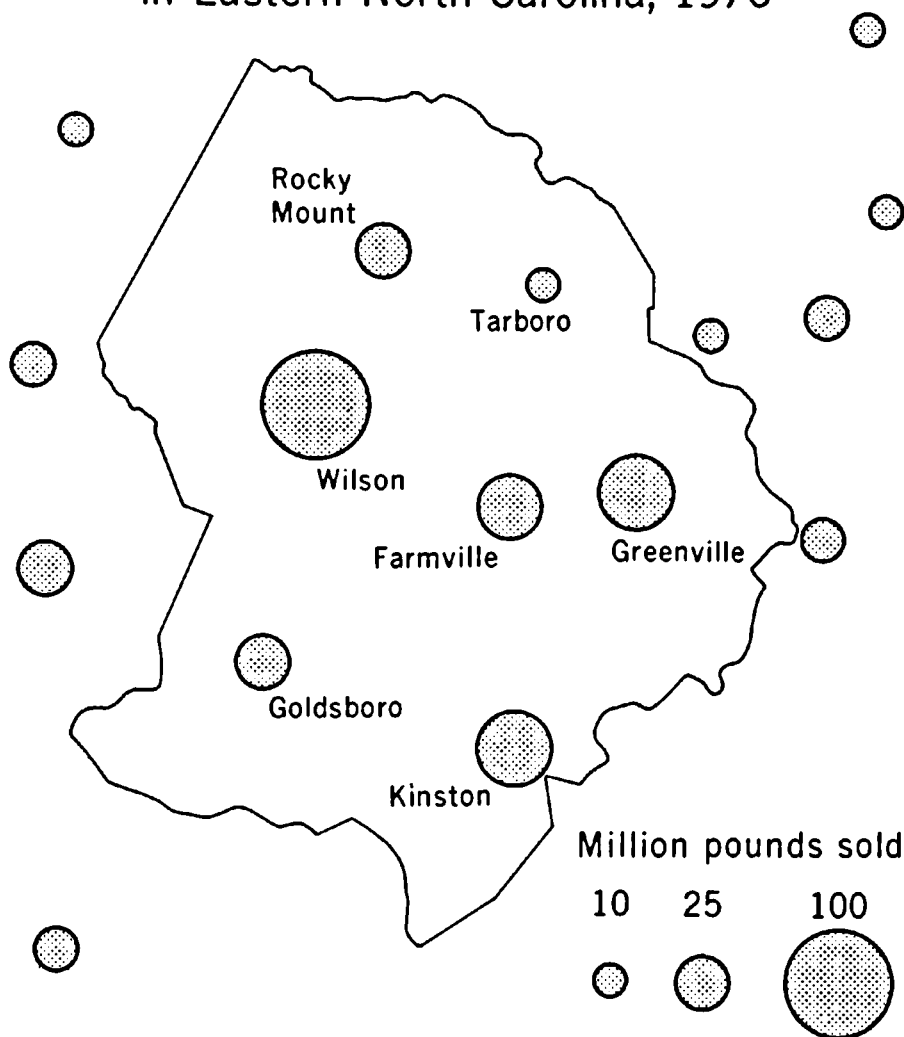
Tobacco seeds, which are so tiny that a single teaspoon can hold more than 100,000, had to be planted in specially prepared seedbeds in late January. Sheets of white cheesecloth that protected the long narrow seedbeds gave a distinctive air to the late winter countryside (Fig. 4).

The first major chore of the tobacco year was transplanting seedlings to the field in late March or early April.⁶ The delicate seedlings had to be transplanted as quickly as possible to avoid loss and to ensure a uniform stand, which was necessary to ensure a

E), North Carolina, *Economics Research Rept. No. 8*, Dept. of Economics, North Carolina State Univ., Raleigh, 1968, p. 35; *idem*, The Effects of Tobacco Price and Allotment Variations on Farm Organizations and Incomes, Northern Piedmont Area, North Carolina, *Economics Research Rept. No. 9*, Dept. of Economics, North Carolina State Univ., Raleigh, 1969, p. 46; and conversations with numerous farmers.

⁶ The old tradition that the crop should be transplanted by the dark of the moon was not without rationale, because the light of a full moon on a clear spring night with crisp temperatures brought out the cutworm, one of a host of pests and diseases that continue to bedevil the tobacco farmer.

Flue-Cured Tobacco Markets in Eastern North Carolina, 1976



The solid line encloses the seven counties (Edgecombe, Greene, Lenoir, Nash, Pitt, Wayne, and Wilson) of State Economic Area 8.

FIG. 3

good harvest. The optimal period for transplanting lasted only a few days, and the task required an enormous labor force. Crews of thirty to fifty workers swarmed across the field to lay off the rows, mark the place for each plant to be inserted, add fertilizer, set the young plants, and give each one a squirt of water.

Labor requirements dropped briefly during the period of cultivation that followed



FIG. 4—Tobacco seedlings being lifted from seedbeds for transplanting to the fields. The seedbeds are protected by sheets of white cheesecloth until the seedlings are large enough to be pulled for transplanting.



FIG. 5—Traditional flue-cured tobacco barn in eastern North Carolina. Under the lean-to shed on the left a "stringing crew" of six women is tying harvested tobacco leaves to sticks that will be hung in the barn for curing.

transplanting, but picked up sharply when the crop had to be "topped" in late May. A young tobacco plant loses all interest in leaf production once it starts to get interested in sex and begins to produce seeds in the flower at the top of its stalk. The tobacco farmer had to get its mind back on business by breaking off the top of each stalk in order to redirect the growth energy of the plant back into leaf production. The plant struck back, however, by producing small worthless leaves called "suckers," two at the base of each leaf. These sucker leaves had to be torn off by hand in the days before chemicals became available to inhibit their growth. The sucker leaves grow quite unevenly, and the field of tobacco had to be suckered at least once a week during the growing season.

The harvest season that began in June required another massive expenditure of hand labor by a work force of twelve to fifteen people or more. The tobacco plant ripens from the ground up, and the bottom leaves are overripe while the top leaves are still green and immature. Each leaf should be pulled from the stalk when it is in its prime, or exactly ripe and ready for harvest; the harvest operation is known as "priming." The tobacco field had to be primed each week for six to eight weeks. Able-bodied men were needed for hand priming, because the job was backbreaking stoop labor, especially in the early stages when the ripe leaves were only six to eight inches above the ground. Primers hunched their way along the rows, pulling two or three ripe leaves off each plant and placing them in mule-drawn sleds that were driven back to the curing barn by youngsters. Most farmers used mules because they believed that the tender leaves would be bruised by tractors moving down the rows.

The leaves of tobacco were cured in cube-shaped barns that measured sixteen to twenty feet on each side and twenty-four feet to the eaves (Fig. 5). A lean-to-roof on one side sheltered a stringing shed, where crews of women tied bunches of ripe leaves to five-foot-long tobacco sticks with loops of string. Two "handlers" picked up two or three leaves at a time and arranged them into a neat "hand" before passing them to the "stringer," who tied them to the stick (Fig. 6). The loaded tobacco sticks were hung on a lattice for tier poles in the barn to be cured; hanging the loaded sticks, and taking them down after the leaves had been cured, was yet another onerous chore. The usual harvest crew for three acres of tobacco consisted of four primers, two drivers, six or eight handlers, three or four stringers, and innumerable small fry underfoot; the job was more than a single family could handle, and even farmers who were below the poverty level had to hire help for the tobacco harvest.

Tobacco was flue-cured by roasting it in the barn for eighty to a hundred hours. A good cure required that the temperature be raised in careful stages to ensure the desired biochemical changes in the leaf while its moisture was being baked out. A squat brick furnace beneath the stringing shed provided heat, which was conducted through twelve-inch flues of sheet metal pipe laid on the barn floor; these flues gave their name to "flue-cured" tobacco. Wood was the common fuel until the 1950's. Someone had to sit up with the barn all night to control its temperature and humidity by manipulating dampers and the fuel supply. The chore of tending the barn became less burdensome when wood was replaced by coal, gas, or fuel oil, and when stoker feeding and thermostatic control provided a more uniform cure with less supervision, but these innovations also ended the colorful tradition of "pigpickings." Workers sitting up with the final cure of the season were allowed to celebrate the end of the harvest by barbecuing a pig over a pit of coals.

The leaf developed a bright golden color after it had been roasted in the barn for

three to five days. This distinctive color gave rise to yet another name, "bright," which is synonymous and interchangeable with "flue-cured" and "Virginia" to describe the tobacco produced in eastern North Carolina and similar tobacco districts. The sticks of cured leaves were taken down and carried to a packhouse where the leaves were untied from the stick, sorted into grades, and tied into hands of



FIG. 6—Stringing crew at work. The two "handlers" on the right pick up loose tobacco leaves from the bench, arrange them into neat "hands" of two or three leaves, and pass them to the "stringer" on the left, who ties them to a tobacco stick that will be hung in the barn. A second stringing crew in the background is partially concealed by the crew in the foreground.

twenty-five leaves to get the crop ready for transportation to the sales warehouse in town.

The sales warehouse was and is an enormous cavernous structure at the edge of the business district (Fig. 7). A good market town has several warehouses that compete vigorously with each other. Each has a vast open sales floor larger than several football fields. The hands of tobacco are placed on rows of wicker baskets on the barn floor and sold by a chanting auctioneer who walks slowly down between the rows. Buyers from tobacco companies walk down the other side of the row and make their bids with hand signals.

MECHANIZATION

The mechanization of flue-cured tobacco production was slow, late, and spasmodic. Transplanting, which had demanded such enormous amounts of hand labor, was the first major operation to be mechanized. Mule-drawn one-row transplanters came into general use before World War II. Transplanting machines undeniably save labor, but still they require two workers for each row, and a dozen people are needed

to operate and service a modern tractor-drawn two-row transplanter (Fig. 8). The latest four-row transplanter is an incredible monster that carries eight workers seated side by side as it lumbers across the field, and hoists them high in the air when it turns at the end of the rows (Fig. 9). The workers sit on low-slung seats behind sixty-gallon tanks of water at the rear of the machine. Seedlings are stacked on a tray in front of



FIG. 7.—Tobacco sales warehouses in Farmville, N.C. Warehouses compete vigorously with each other, and the personalities of individual auctioneers play a major role in the amount of business they are able to attract.

each worker, who places them in slots on a revolving arm that inserts them into the soil, packs it snugly around them, and gives each one a squirt of water.

Labor-saving procedures were applied to suckering before they were applied to topping. The seemingly endless summer chore of pulling off the sucker leaves was virtually eliminated when chemical sucker-control sprays became available in the late 1950's, although the application of additional chemicals did little to allay the anxiety of those who were already concerned about the health hazard posed by tobacco. Topping machines came into widespread use in the late 1960's. These terrifying devices have rotary blades, like those of a power lawn mower, that are mounted at the height of a tobacco flower (or a man's head). A single operator can handle up to twenty acres a day with one of these machines, which tops the plants and sprays them with a sucker-inhibiting chemical in one pass down the row (Fig. 10).

Harvesting has been the most difficult tobacco operation to mechanize, because the identification of ripe leaves requires human judgment. The first feeble start, which proved to be a dead end, was an automatic stringing machine that eliminated the necessity of tying the leaves to tobacco sticks by hand and reduced the harvest labor need from 240 hours an acre to a mere 180. The first machines that were used for



FIG. 8—One-row tobacco transplanter. Two men are kept busy feeding seedlings into the machine as it crawls across the field. (Photograph courtesy of Woody Upchurch, North Carolina State University.)



FIG. 9—Four-row tobacco transplanter in operation. These labor-saving machines require only eight workers plus a tractor driver. (Photograph courtesy of Woody Upchurch, North Carolina State University.)



FIG. 10—Tobacco topper-sprayer in operation. This fearsome machine slices off the flowering seedhead of each plant and sprays the rest of the plant with a chemical that inhibits the growth of sucker leaves. (Photograph courtesy of the Powell Company.)



FIG. 11—"Taxi-rig" tobacco harvester in operation. The tobacco leaves in the foreground conceal four primers riding at ground level. The primers tear the ripe bottom leaves from each plant and place them in a conveyor belt that carries them to the workers on the platform.

priming were called "taxi" rigs, because they were merely vehicles on which workers could ride. Taxi rigs, which were introduced in 1954, are cumbersome contraptions with four seats for primers near the ground and a platform eight or nine feet above it. The seated primers pull the ripe leaves from the stalks as the machine wobbles across the field, and they place the leaves in the fingers of a conveyor belt that carries them to



FIG. 12—Mechanical tobacco harvester in operation. Cutter blades on the machine are set to slice off all leaves between specified heights on each plant. This machine can be operated by a single worker, but several other workers are needed to truck the harvested leaves to the curing barn. (Photograph courtesy of the Powell Company.)

the platform, where stringers tie them to tobacco sticks (Fig. 11). The taxi rig eliminated four handers, but still required four primers, two stringers, and a driver; the subsequent switchover to bulk curing has also eliminated the need for stringers. The taxi rig did not reduce labor needs so much as it modified them; the farmer with a taxi rig could employ women, children, and older men who were not sturdy enough for the backbreaking labor of priming while walking.

Mechanical harvesters, which came onto the market in the late 1960's, really do reduce labor needs, because they are operated by a single person. The operator decides the height at which leaves are to be harvested and sets cutter blades to remove all the leaves between specified heights on each stalk (Fig. 12). Some leaves in this height zone are already overripe, and others are still green, but the sacrifice of a few leaves seems a small price to pay for the enormous saving in labor. A conveyor belt carries the leaves to the back of the machine and dumps them into a bulk rack to be taken to the curing barn.

The development of mechanical harvesters was associated with the widespread adoption of new bulk-curing barns that have almost completely replaced the tradi-

tional cube-shaped flue-curing barn. This replacement has been so complete, in fact, that the term "flue-cured" is already obsolescent, although presumably it will have the same tenacity as "Virginia" in describing the tobacco grown in the Carolinas. A shiny new metal bulk barn, which looks for all the world like a trailer, has a large fan that forces heated air through the barn instead of depending on convection from a flue



FIG. 13—Battery of bulk-curing barns. A central shed roof shelters workers who pack harvested leaves in the barns. The tightly packed leaves are cured by heated air that is forced through them by fans. (Photograph courtesy of the Long Company.)

on the floor (Fig. 13). Bulk barns are fully automated, with electrical control panels and batteries of dials that can program the precise degree of cure desired for a particular batch of tobacco. They may also be used to dry peanuts, to dry and store small grains, and to presprout and cure sweet potatoes when they are not needed for curing tobacco. The workers at the bulk barn pick up armfuls of loose tobacco leaves and cram them into metal racks that are clamped shut and packed tightly in the barn. Labor needs are appreciably reduced, because the leaves no longer have to be tied to sticks before they have been cured. Furthermore, the cured leaves no longer need to be tied into hands before they are taken to the sales warehouse, because marketing regulations in North Carolina were changed in 1968 to permit leaf to be sold loose instead of having to be tied into hands, and the entire crop is now sold as loose leaf.

THE CONTEMPORARY COUNTRYSIDE

The contemporary countryside of eastern North Carolina reflects the impact of the mechanization of tobacco production. A clutter of old buildings that are no longer needed stands alongside the new buildings that have superseded them. Most farmers

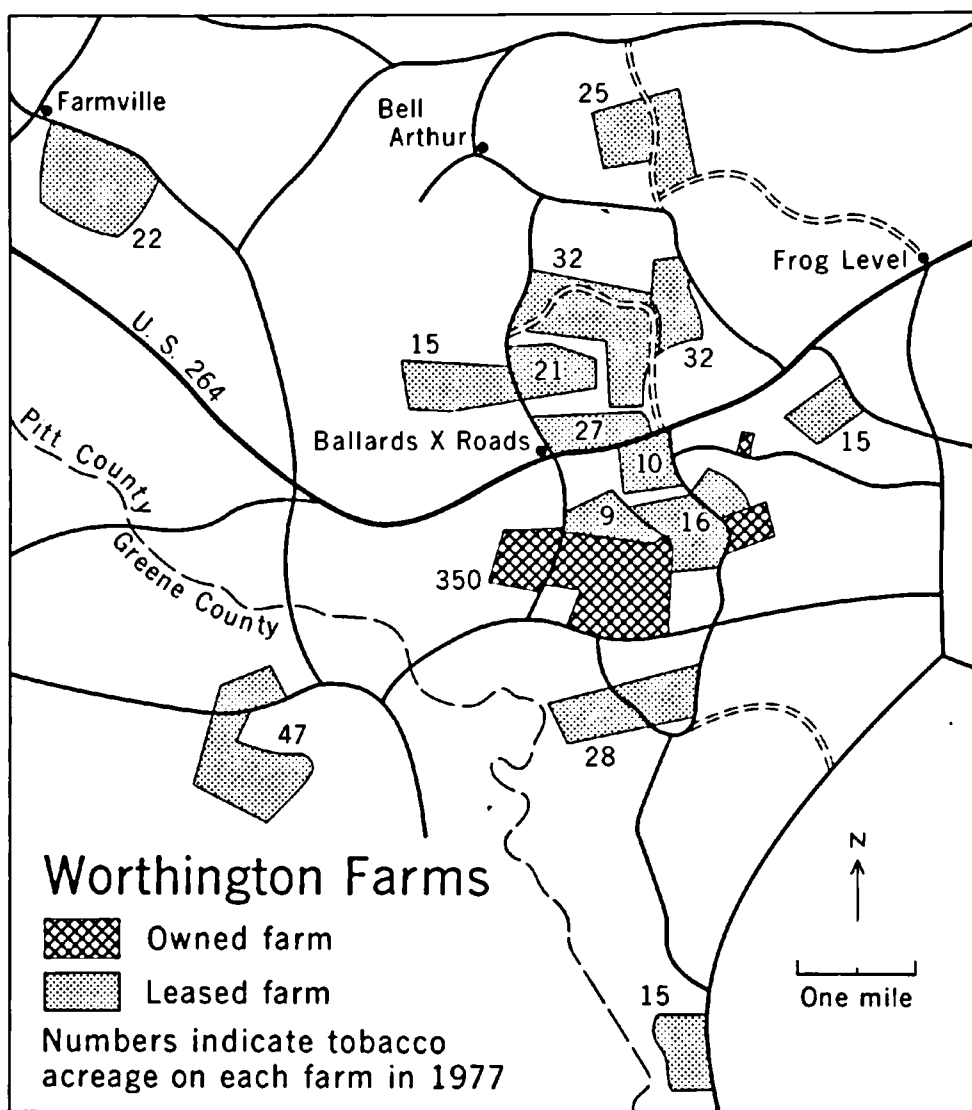


FIG. 14—The Worthington Farms operation between Greenville and Farmville, North Carolina, has been expanded from the original family-owned farm by renting land from other landowners in the vicinity.

are content to let the old houses and barns remain, decay, and eventually collapse, instead of giving them a shove. The old packhouse is superfluous, because the cured leaf does not have to be removed from tobacco sticks and tied into hands; it goes directly from the bulk barn to the floor of the sales warehouse. Mule barns are reminders of days gone by, and occasionally one still sees an old retired mule gazing dolefully at a clump of shiny new farm implements. At first many farmers allowed their valuable new equipment to stand out in the steamy Carolina weather, but recently they have begun to use open prefabricated metal storage sheds.

The adoption of newer and larger machines has forced farmers to change the layout of their fields. In many fields every fifth row is left bare for the wheels of machines; the skipped row is moved laterally each year, permitting the soil to rest one



FIG. 15—Abandoned rural house on an unpaved back road near Greenville, North Carolina.

year in five. Nevertheless, the sandy soils require heavy fertilization, not only for tobacco but also for peanuts, corn, soybeans, cotton, and other field crops that are grown in the area. Streams carry the fertilizer residues into Pamlico Sound, and estuarine eutrophication is potentially a serious threat for the coastal areas that have been enjoying a booming recreational business.

Eastern North Carolina has always had far more barns per square mile than other flue-cured tobacco districts. Most of the old flue-curing barns were of unpainted wood or were sheathed in green or black tar paper held in place by vertical wooden battens. The barns were grouped in clusters, but spaced far enough apart to keep all from going up in smoke if one caught fire, as often happened.⁷

The most obvious feature of the new tobacco countryside is the shiny new metal bulk-curing barns, which often stand in parallel batteries of three to ten or more. An open shed running the full length of the battery shelters a working area at the ends of the barns where the racks of tobacco are inserted and removed. Bulk barns may be clustered, because their heating systems pose no greater fire hazard than any ordinary home heating system, and clustering them means that the farm has only one point to which power lines must be run, one point to which oil or propane gas must be delivered, one point to which tobacco leaf must be hauled for racking and curing, and one point from which cured leaf must be hauled to the sales warehouse.

Mechanical harvesting and bulk curing require only five workers, a substantial

⁷ Local insurance adjusters had to be able to sift through the ashes of a burned barn and make a reasonable estimate of the amount of tobacco leaf it had contained, because for some mysterious reason a barn never burned unless it was completely full of tobacco—or at least that is what the owner always claimed.

reduction from the traditional harvest crew of twenty, but most farmers outside eastern Carolina would blanch at the prospect of having to assemble a harvest crew even that large. The principal benefit of mechanization for the East Carolina tobacco



FIG. 16—New rural subdivision of brick homes on a paved highway east of Ayden, North Carolina. Four of the sixteen visible driveways have two parked cars, indicating the importance of commuting. (Photograph courtesy of Lynn Quinley.)

farmer has not been so much a reduction of his labor requirements as a change in them. He can use women and young people in place of the able-bodied males who have taken jobs in the factories that have been springing up in the area, but he still needs a few regular salaried male workers to operate and maintain his expensive machinery. Husky high school football players are especially useful summer workers around bulk barns, where a premium is placed on packing the leaves as tightly as possible.

MECHANIZATION AND FARM ENLARGEMENT

One often wonders whether labor shortages force farmers to mechanize, or whether mechanization drives farm workers from the land. The mechanization of tobacco in eastern Carolina seems to have a chicken-and-egg relationship with industrial development: some farm workers undoubtedly were displaced when innovative farmers adopted new machines, but some conservative farmers undoubtedly

were compelled to adopt new machines because they could no longer rely on their former labor supply. One can easily find numerous examples of each, and it is impossible to say which has been more important. Certainly competition from new urban jobs, whether in factories or elsewhere, has forced all farmers to use labor more efficiently, because farm wage rates doubled between 1950 and 1970. Steady, better-paying jobs in town have been especially attractive to able-bodied men, and tobacco farmers have been forced to rely more heavily on machinery and casual labor for their intense seasonal spurts of activity.

It would be completely wrong, however, to assume that all tobacco farmers were forced to mechanize by labor shortages, and it is unnecessary to postulate any particular triggering device for tobacco mechanization, because many farmers, for a wide variety of reasons, both good and bad, have disliked having to rely on a large black labor force, and this dislike alone could have encouraged them to ponder the possibilities of replacing black workers with machines.

The various phases of tobacco production have been mechanized quite unevenly, some much earlier than others, and the mechanization of one operation often has turned another into a bottleneck. The farmer who acquires one piece of new equipment often finds that he must acquire another new piece for another stage of production. The mechanical harvester, for example, can prime tobacco faster than it can be handled by a traditional flue-cured barn, but the farmer who buys a new and larger harvester may have to add more bulk barns in order to keep up with his new machine. The potential efficiencies of mechanization can be realized only when the total technology has been adopted, but even then modifications will be necessary as new and better machines come on the market.

The introduction of new farm machines almost inevitably results in farm enlargement, because the real cost of a piece of farm equipment is closely related to the amount of ground that it can and does cover. A farmer cannot afford a new machine unless he has enough land to keep it busy, and the acquisition of one often forces him to enlarge the size of his operation. It has been estimated, for example, that a mechanical tobacco harvesting system cannot be operated efficiently with fewer than forty acres of tobacco, but few farmers even in eastern North Carolina, where tobacco farms are relatively large, had as much as ten acres under the crop as late as 1970.

Tobacco farms in eastern North Carolina have been enlarged by the consolidation of smaller units into larger ones, although the process has been hindered by a fairly rigid framework of government controls. The government maintains the price of flue-cured tobacco with a price support system, but in return it exercises strict control over the acreage of the crop that each farmer may plant, and since 1965, of the number of pounds he may sell. The secretary of agriculture sets the total acreage and poundage of flue-cured tobacco that may be produced in the United States each year. Acreage and poundage quotas are "allotted" to the individual states on the basis of their percentage of the national total in a selected "historic base year." The state quotas are allotted to counties within the state on the same basis, and the county quotas are allotted to farmers in the same way.⁸

The tobacco acreage allotment was tied to each individual farm. The allotment

⁸Quotas on acreage and poundage require a tobacco farmer to do some fairly fine calculation, because harvesting and marketing account for roughly three-quarters of his total production costs. In a good year, when his allotted acreage has produced more than the poundage he is permitted to sell, he can save money by leaving part of the crop standing in the field. Observant travelers in eastern Carolina sometimes are surprised by the amount of tobacco that remains in the fields unharvested.

system "froze" tobacco acreage where it had been in the historic base year, because the only farmers who received allotments and were permitted to grow the crop were those who had grown it in the historic base year. Those farmers who did not wish to continue growing tobacco, for whatever reason, found the allotments were a bit like pet elephants—awkward to cope with, but much too valuable to give away. The

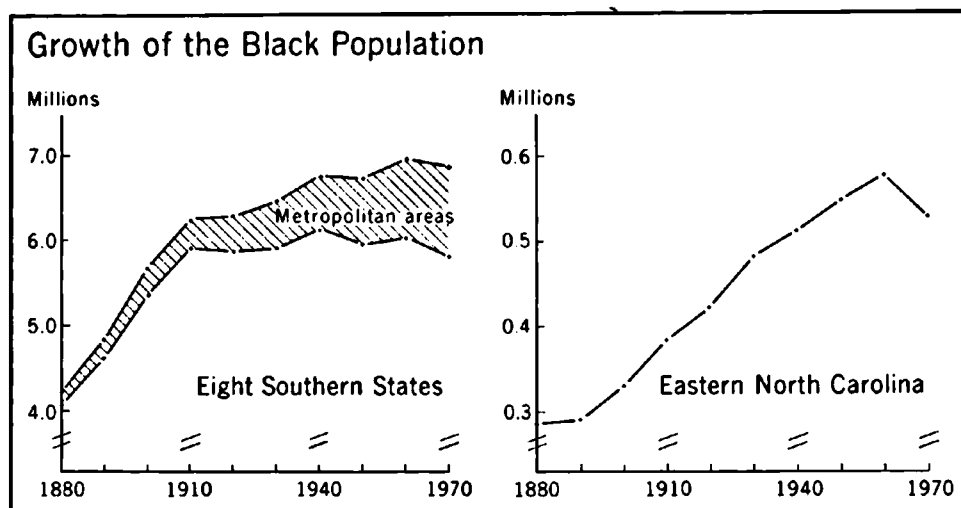


FIG. 17—Growth of the black population in the eight states from Arkansas and Louisiana eastward to the Carolinas (left), and in North Carolina east of the Yadkin River (right). Black population growth in the cotton South since World War I has been concentrated in four major metropolitan areas (New Orleans, Atlanta, Memphis, and Birmingham), but the demands of flue-cured tobacco production kept black people on the land in eastern North Carolina until the crop began to be mechanized in the 1960's.

allotment system also restricted the farmer who wished to begin growing tobacco, or even to increase his acreage of the crop, and in 1962 the system was modified to permit the holders of allotments to rent or sell them, first within the county, and in later years within the state, but in 1978 still not yet across state lines.

Many tobacco farmers were only too happy to rent or sell their allotments, for a variety of reasons. Although the new mechanical harvesting systems can halve their labor needs, these systems require a heavy capital investment, and farmers who had doubts about long-range demands for the crop were reluctant to take the risk of investing in the expensive new machines. Tobacco farmers are well aware of the obvious conflicts between government policies that encourage the production and export of cigarette tobacco, because of its long-standing importance to the local and national economy, and those that discourage cigarette smoking, because it is dangerous to human health. They also know that the tobacco companies have steadily reduced the amount of tobacco used per thousand cigarettes manufactured. Many of these farmers who are concerned about the future of tobacco have chosen to concentrate on the production of other cash crops, such as peanuts, cotton, corn, and soybeans.

Eastern North Carolina has had the largest tobacco farms in the United States, and this area has led the way to mechanization, but even here the crop had become a headache for many farmers. Sharecropping had been the principal institutional

arrangement that could provide the labor force they needed, but sharecropping placed a responsibility on the farmer that was almost as onerous as the burden it placed on the sharecropper. Between 1950 and 1960, in fact, most farmers shifted from sharecroppers to hired labor and paid wages, but many tobacco farmers were delighted to transfer their allotments, for a price, to the innovative farmers who had

TABLE II—FLUE-CURED TOBACCO IN STATE ECONOMIC AREA 8,
EASTERN NORTH CAROLINA, 1954 AND 1974*

	1954	1974
Number of farms	26,315	6,331
Acres of tobacco	161,365	90,862
Pounds of tobacco (in thousands)	216,279	189,339
Pounds per acre	1,340	2,084

Sources: "U.S. Census of Agriculture: 1954. Vol. I, Counties and State Economic Areas, Part 16, North Carolina and South Carolina" (Bur. of the Census, Washington, D.C.) County Table 9 (Part 4 of 5); and "1974 Census of Agriculture, Vol. I, State Reports, Part 33, North Carolina, State and County Data" (Bur. of the Census, Washington, D.C.) Chapter II, Table 26.

* State Economic Area 8 includes Edgecombe, Greene, Lenoir, Nash, Pitt, Wayne, and Wilson counties.

invested in the new machines and needed more land to keep their machinery effectively occupied.

The transfer of tobacco allotments has greatly reduced the number of tobacco farms and appreciably reduced tobacco acreage, but the consolidation of this acreage on the land best suited to tobacco has increased yields and maintained production at a fairly stable level. Between 1954 and 1974, for example, the number of tobacco farms in State Economic Area 8 in eastern North Carolina dropped by 76 percent and the acreage of tobacco dropped by 44 percent, but production dropped only 12 percent because yields per acre almost doubled (Table II). Approximately 3,500 acres went out of tobacco production each year. A small part of this land has been taken over by urban growth, and some of it has been planted to other crops, such as corn, soybeans, and peanuts, but much of it simply has been allowed to revert to brush.

The retirement of marginal agricultural land from cultivation has been one of the serendipitous side effects of the rapid growth of farmland leasing throughout the United States since World War II. In recent years most American farmers who have wished to enlarge their operations have done so by renting land instead of buying it. The man who owned only a small acreage was compelled to cultivate nearly all of it in order to scratch out a living, but a renter who is enlarging from an existing land base can afford to be far more selective, and he does not need to use those parts of the rented farm that are not worth cultivating.

Dispersing the tobacco crop on scattered, often noncontiguous, parcels of rented land also reduces the weather risk, and a surprisingly large number of farmers who have bought or rented tobacco allotments have been happy to continue growing the crop on the better land of the former farm even after a change in the regulations permitted them to transfer the acreage to their own farms. Summer precipitation in eastern Carolina comes mainly as thundershowers, and thundershowers are notoriously spotty. Scattering tobacco land around the county reduces the danger that the entire crop will be wiped out by hail, parched by the failure of thundershowers to hit a particular field, or drowned by extremely heavy showers that overload field drains.

(Few places in eastern Carolina are as much as sixty feet above sea level, and the land must be drained before it can be cultivated.)

CHANGING PATTERNS OF SETTLEMENT

A modern tobacco farm in eastern North Carolina is no longer a solid block of land; it consists of numerous parcels that may be scattered over a radius of ten miles or more (Fig. 14). The old family farmstead has been converted into a tobacco-curing station, with great batteries of new bulk barns. Nearby are permanent central seedbeds from which seedlings are trucked to all the fields, however distant. The farmer owns the old homeplace, and he may have bought one or two other farms, but much of his land is rented from others. He rents land wherever it happens to be available, and it is sheer luck if the homeplace happens to be central to the parcels of land he farms. The farmer may choose to continue to live in the old family home, but he is no longer tied to a particular piece of ground, and he is free to live wherever he wishes. A growing number of farmers, perhaps one of every seven, have become sidewalk farmers. They have moved to modern new homes at locations they and their families consider more attractive. The new home may be in town, but it may equally well be in a pleasant rural area.

The old farm home, which is close to the highway, may have been converted into a farm headquarters building, or it may have been turned over to one of the black farm workers and his family. Other black families have also moved up to the highway, either into former white farm homes or into new houses, and the old unpainted shacks in the back country have been abandoned right and left (Fig. 15). Rows of new brick houses are scattered along the highways of eastern North Carolina. Southerners, both black and white alike, seem to have a penchant for brick houses. The glib assumption that whites live in the better rural houses and blacks in the poorer ones is no longer valid, if indeed it ever was. Today one can tell the color of the occupants only by ringing the doorbell, unless someone happens to be out in the yard.

The automobile has emancipated farm people from the land they till, and nowadays farm workers as well as farmers are free to live where they please. Whites are willing to move to a convenient town, but a surprising number of black people seem to prefer to live in the countryside, where they probably have access to better and newer housing, where they can have a garden, and where they may be less liable to stressful confrontations with white neighbors. Numerous subdivisions of new brick houses have been developed for black people (Fig. 16). These new subdivisions are well out in the country, but they are near enough to good paved highways to permit easy long-distance commuting in an area where winter driving holds fewer terrors than in many parts of the nation. Most of the black workers have factory or city jobs, but some of them commute to the newly mechanized farms that pay competitive wages to retain a cadre of reliable workers.

INDUSTRIALIZATION

The heavy labor requirements of flue-cured tobacco kept large numbers of black people on farms in eastern North Carolina until racial integration of factories had become an accepted and acceptable fact of life, and redundant farm workers could find jobs in the new factories that were being built in the local area. The black

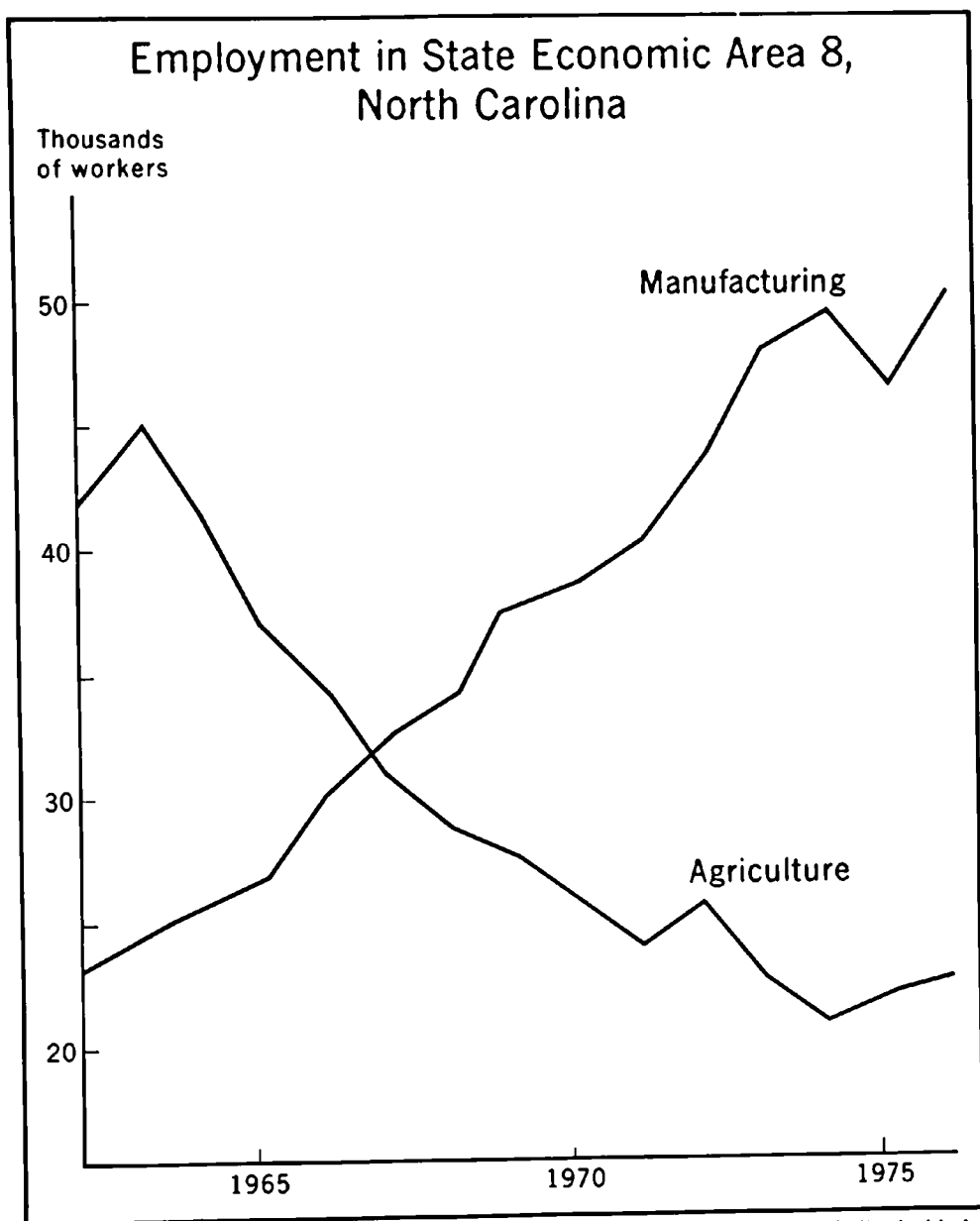


FIG. 18—Employment in agriculture in North Carolina's State Economic Area 8 has declined with the mechanization of flue-cured tobacco but the slack has been taken up by a rapid increase in employment in manufacturing. (This graph is based on unpublished data made available by Donald A. Brand, Director, Bureau of Employment Security Research, North Carolina Employment Security Commission, Raleigh, North Carolina.)

population in that part of the state east of the Yadkin River increased steadily from 1890 until 1960, and did not start to drop off until after 1960, when the mechanization of tobacco was in full swing (Fig. 17).⁹ The growth of the black population had leveled

⁹ John Fraser Hart: The Changing Distribution of the American Negro, *Annals Assn. of Amer. Geogrs.*, Vol. 50, 1960, pp. 242-266, reference on pp. 254-256.



FIG. 19.—New rural factory near Wilson, North Carolina. The size of the employee parking lot reflects the importance of commuting. (Photograph courtesy of the Regional Development Institute, East Carolina University.)

off half a century earlier in the cotton South (the eight states from Arkansas and Louisiana eastward to the Carolinas). Black people who were “displaced” from (or wished to leave) the cotton districts were virtually forced to migrate to cities in the North because so few jobs were available for blacks in the segregated cities of the South, and it was black people from the cotton areas who made up the great bulk of the massive black migration northward.

Black people have also migrated to the North from eastern North Carolina, to be sure, but in far smaller numbers, because the massive labor requirements of flue-cured tobacco production kept many black workers in the area until jobs began to open up in integrated factories. Eastern North Carolina probably is the only part of the United States where a large native black population has been integrated *in situ*; blacks native to other areas in the South were not integrated until after they had been uprooted by migration to cities, either within or without the region.

A boom in manufacturing employment in eastern North Carolina coincided with the mechanization of tobacco in the area. The number of workers employed in manufacturing in State Economic Area 8, for example, skyrocketed from 24,700 in 1963 to 50,606 in 1976, while the number of persons employed in agriculture was plummeting from 45,020 to only 22,950 (Fig. 18). One could waste considerable time arguing about whether new factories were attracted by a labor pool of farm workers “displaced” by farm mechanization, or whether farmers were compelled to mecha-

nize because industry deprived them of their labor force. It seems clear that there was a little bit of both. There can be no question that branch plants of national corporations were attracted to the area by the availability of a cheap labor force, but it is equally clear that many tobacco farmers lost part of their labor force to the jobs that became available in the new factories.

The fall of 1977 was not an auspicious time to try to obtain firsthand information about the reasons for industrial growth in eastern North Carolina, or try to delineate the commutersheds of the new factories.¹⁰ Labor unions were engaged in a determined effort to force employers to accept unionization. Battle lines had been drawn, and both sides were suspicious of strangers, even strangers with scholarly credentials. Many workers, who "had never had it so good" before, were just as suspicious as those for whom they worked. Spokesmen for most companies boasted that the proportion of blacks in their labor forces was quite close to the proportion of blacks in the local population, about 37 percent, but they quickly clammed up when asked for information about the distance their workers commuted. "I would be willing to let you have an address list of our workers," was a common response, "but if I did I would also have to give it to any blooming union organizer who asked for it."

Information published in the U.S. Census of Manufactures, however, reveals that the State Economic Area 8 grew from only thirteen establishments employing 250 or more workers in 1958 to fifty-one in 1972.¹¹ The apparel and textile industries predominate, but nearly every major industry group was represented by at least one large factory in 1972, and the only location factor common to all of them seems to be their need for a large labor force. Industrialization has not been associated with urbanization, because most of the large new factories lie outside municipal boundaries (Fig. 19). They spew massive loads of traffic onto the overcrowded highways at the end of each shift, because many of their workers commute great distances from highwayside homes in rural areas.

One might argue that branch plants of national corporations that have been attracted by a cheap labor force will not provide a sound base for sustained economic growth, because they might move on to Mexico or Hong Kong or Korea when wages begin to rise in eastern North Carolina, but such plants have certainly undergirded the first step in the economic transition from agriculture to industry.

SUMMARY

The mechanization of a major crop has wrought a revolution in the rural areas of eastern North Carolina. The most dramatic landscape manifestation of this revolution has been the replacement of tens of thousand of old flue-cured tobacco barns, which now stand derelict, by shiny new metal bulk-curing barns. Fields are now laid out with every fifth row bare, to accommodate the wheels of the large new machines. Farmers have been obliged to acquire more land in order to use these machines with maximum efficiency, and they have been forced to go ever farther afield to buy or rent

¹⁰ In 1964, factories in eastern North Carolina had commutersheds with radii of 20 to 40 miles, and there is no reason to suppose that they have shrunk in the intervening years (Richard E. Lonsdale: *Two North Carolina Commuting Patterns*, *Econ. Geogr.*, Vol. 42, 1966, pp. 114-138, reference on pp. 122-123).

¹¹ "U.S. Census of Manufactures: 1958. Vol. III, Area Statistics, Part 32, North Carolina" (Bur. of the Census, Washington, D.C.), Table 7; and "Census of Manufactures, 1972. Vol. III, Area Statistics, Part 2, Nebraska-Wyoming, Section 34, North Carolina" (Bur. of the Census, Washington, D.C.), Table 9.

the land they needed. The dispersion of farm operations has emancipated farmers from residence on the land, and many of them have moved into nearby towns and become sidewalk farmers.

The heavy labor requirements of flue-cured tobacco production kept black workers on the land until jobs became available to them in factories that were attracted to the area by the labor force that was being released by farm mechanization. Many factory workers, black and white alike, prefer to remain in the country instead of moving into town, and rural roads are lined with new brick houses whose residents commute long distances to their jobs. These new homes along the highway, like the new bulk barns that adorn the farmsteads and the new factories that are sprinkled through the area, reveal that the release of the farm labor force by the mechanization of the leading crop, and the concomitant growth of industry that has been attracted by that released labor force, have enabled eastern North Carolina to make the transition from an agricultural to a mixed economy—the dream of many lesser-developed countries in the Third World—in less than a single human generation.

EXCLUSIONARY ZONING AND OPEN HOUSING: A BRIEF JUDICIAL HISTORY*

PAUL E. KING

IN THE past thirty years metropolitan areas in the United States have undergone dramatic changes in their spatial structure as a result of the dispersal and suburbanization of both housing and jobs. Although the suburbs now contain more people than either central cities or rural areas, growth and migration have been highly selective. Middle- and upper-income families, corporate offices, and the least noxious forms of manufacturing and trade have been moving out to the suburbs in increasing numbers. Lower-income and minority families, on the other hand, have remained in the central cities, where they compete in stagnating markets for jobs and housing. This has left city governments with the challenge of financing increasingly expensive public services from shrinking tax bases. The suburbs have tried to avoid these urban problems, for which they are partly responsible, by instituting measures to prevent tax-draining activities from following those that pay their way. These measures attempt to exclude all land uses that do not generate more in real property tax revenues than they consume in expenditures for public services.

The National Commission on Urban Problems clearly identified the range of these exclusionary devices available to incorporated communities in 1968.¹ It included large-lot zoning, the exclusion of multiple-dwelling units, specifications for minimum house-size requirements, the exclusion of mobile homes, and the establishment of excessive subdivision requirements, to which should be added slow-growth and no-growth ordinances. The general effect of all of these devices has been to increase the cost of development and consequently the price of housing. Thus it has been argued that exclusionary practices, particularly zoning, constitute one of the major factors responsible for limiting the dispersal of low- and moderate-income families into suburban areas. These activities have come under increasing judicial attack in recent years, with suburban neighborhoods clearly segregated on the basis of income, social class, and color being cited as *prima facie* evidence of the exclusionary nature of local land use control.² In this paper I shall provide an overview of the development of land use controls at the

* An earlier, much-abbreviated, version of this paper was presented at the annual meeting of the Middle States Division, Association of American Geographers, East Stroudsburg, Pennsylvania, October 15, 1976.

¹ "Building the American City" (Nat'l. Commission on Urban Problems [The Douglas Commission], Washington, D.C., 1968).

² The literature on zoning is vast, although few geographers have written on the subject, and only some basic sources are listed below. See Richard F. Babcock and Frederick P. Bosselman: *Exclusionary Zoning: Land Use Regulation and Housing in the 1970's* (Praeger Publishers, New York, 1973); *idem*, *Suburban Zoning and the Apartment Boom*, *Univ. of Pennsylvania Law Rev.*, Vol. 3, 1963, pp. 1051-1072; Edward M. Bergman: *Eliminating Exclusionary Zoning: Reconciling Workplace and Residence in Suburban Areas* (Ballinger Publishing Co., Cambridge, Mass., 1974); Mary E. Brooks: *Exclusionary Zoning* (Amer. Soc. Planning Officials, Chicago, 1970); Linda and Paul Davidoff and Neil N. Gold: *The Suburbs Have to Open Their Gates, in Suburbia in Transition* (edited by Louis H. Masotti and Jeffrey K. Hadden; New Viewpoints, New York, 1974), pp. 134-150; Anthony Downs: *Opening Up the Suburbs: An Urban Strategy for America* (Yale Univ. Press, New Haven, Conn., 1973); Charles M. Haar: *The Social Control of Urban Space, in Cities and Space: The Future of Urban Land* (edited by Lowden Wingo; Johns Hopkins Press, Baltimore, 1963), pp. 175-229; *idem*, *Land Use Planning: A Casebook on the Use, Misuse and Re-Use of Urban Land* (Little Brown and Co., Boston, 1971); David Harvey: *Society, the City and the Space Economy of Urbanism*, *Assn. of Amer. Geogr., Comm. on College Geography, Resource Paper No. 18*, Washington, D.C. 1972, pp. 21-25; Daniel R. Mandelker: *The Zoning Dilemma: A Legal Strategy for Urban Change* (Bobbs Merrill, Indianapolis, 1971); Louis H. Masotti and Jeffrey K. Hadden, eds.: *The Urbanization of the Suburbs* (Urban Affairs Annual Reviews, Vol. 7; Sage Publications, Beverly Hills, Calif., 1973); Peter O. Muller: *The Outer City: Geographical Consequences of the Urbanization of the Suburbs*, *Assn. of Amer. Geogr., Comm. on College Geography, Resource Paper No. 75-2*, Washington, D.C., 1975, pp. 23-24; Rutherford H. Platt: *Land-Use Control: Interface of Law and Geography*, *Assn. of Amer. Geogr., Comm. on College Geography, Resource Paper No. 75-1*, Washington, D.C., 1975, pp. 20-23.

local level and assess the judicial activity surrounding exclusionary practices. I shall conclude with a prognosis for residential segregation based on income as well as color.

The current instruments of exclusion have evolved slowly over the past century in response to subtle changes in political, social, and economic environments. However, several distinct phases can be discerned. First to be identified is a period before 1926, when the question of local land use control was first raised and debated. A second phase, which lasted until World War II and during which land use controls proliferated, was initiated by the landmark ruling of the U.S. Supreme Court in *Village of Euclid v. Ambler Realty* in 1926. In this case the Supreme Court first sanctioned comprehensive zoning as a planning tool. Postwar developments can be conveniently divided by the year 1965 into two distinct phases. Before that year zoning ordinances generally withstood legal challenges, but after 1965 a number of courts began to declare particular zoning regulations unconstitutional. Each of these periods will be discussed in turn before identifying the significant differences in attitudes toward exclusion between the state and federal courts. Finally, an assessment will be made of slow-growth and no-growth ordinances which, in conjunction with zoning, have significant implications for residential exclusion.

EARLY DEVELOPMENTS

Power to enact land use controls at the local level dates back only to the early years of the twentieth century. The issues at stake before 1926 involved the basic conflict between private property and the public good, and whether land use controls were to be administered by local or state agencies. Although during this period arguments were weighted heavily in favor of the individual and private development rights,³ some courts began to recognize an overriding concern for the general welfare of the populace, in some cases at the expense of the individual.⁴ Many state legislatures began to recognize the concept of local control, and when cases rose to the U.S. Supreme Court local ordinances were generally upheld.⁵ Cities across the country began to follow the lead of New York, which enacted the first comprehensive zoning ordinance in 1916.

In response to the flurry of activity at both the state and local levels an advisory committee on zoning was established by the U.S. Department of Commerce. The committee sponsored a Standard State Zoning Enabling Act in 1922⁶ which was widely adopted over the next few years, and a related advisory group produced a Standard City Planning Act in 1926.⁷ These "model" laws set the pattern for states to delegate land use control under the police power to local authorities to promote the "health, safety, morals or general welfare of the community."⁸ According to the Standard State Zoning Enabling Act,

the legislative body of cities and incorporated villages is hereby empowered to regulate and restrict the height, number of stories, and size of buildings and other structures, the

³ See, for example, *Spann v. Dallas*, 111 Tex. 350, 212 S.W. 513 (1921); and also *Ignaciunas v. Risley*, 98 N.J.L. 712, 121 A. 783 (1923).

⁴ See, for example, *Carler v. Harper*, 182 Wisc. 148, 196 N.W. 451 (1921); and *Miller v. Board of Public Works of Los Angeles*, 195 Cal. 477, 234 Pac. 381 (1923).

⁵ See, for example, *Welch v. Swasey*, 214 U.S. 91 (1909), in which height limits on buildings in parts of Boston were upheld as a preventive against fire; and *Reinman v. City of Little Rock*, 237 U.S. 171 (1915) and *Hadacheck v. Sebastiani*, 289 U.S. 394 (1915), in which incompatible uses were forced to vacate certain areas. One of the few local land use measures that was struck down was in *Eubank v. City of Richmond*, 226 U.S. 137 (1912), involving building setbacks.

⁶ "Standard State Zoning Enabling Act Under Which Municipalities May Adopt Zoning Regulations" (Advisory Committee on Zoning, U.S. Dept. of Commerce, Washington, D.C., 1922). This was revised in 1923 and again in 1926.

⁷ "A Proposed Standard City Planning Enabling Act" (Advisory Committee on City Planning and Zoning, U.S. Dept. of Commerce, Washington, D.C., 1926).

⁸ "A Standard State Zoning Enabling Act" (U.S. Dept. of Commerce, Washington, D.C., 1926 revision), sec. 1, p. 4.

percentage of lot that may be occupied, the size of yards, courts, and other open spaces, the density of population, and the location and use of buildings, structures, and land for trade, industry, residence or other purposes.⁹

An explanatory note to the text is of particular interest, for it suggests that "the power to regulate density of population is comparatively new in zoning practice. It is, however, highly desirable."¹⁰ The Standard Act continues with the exhortation that

such regulation shall be made in accordance with a comprehensive plan . . . and . . . with reasonable consideration among other things to the character of the district and its particular suitability for particular uses, and with a view to conserving the value of buildings and encouraging the most appropriate use of land throughout such municipality.¹¹

Another note further amplifies these points: "Zoning is not intended to enhance the value of buildings but to conserve that value—that is, to prevent depreciation of values such as come in 'blighted districts,' for instance—but it is to encourage the most appropriate use of land."¹²

"EUCLIDEAN" ZONING

It was in this general climate that the village of Euclid, Ohio, a suburb of Cleveland, passed a comprehensive zoning ordinance which placed severe restrictions on apartments and businesses. The Ambler Realty Company brought suit on the takings issue, arguing that land potentially valued at \$10,000 an acre had been reduced in worth to \$2,500 as a result of being zoned for residential use only. The trial court ruled in favor of Ambler Realty and declared the Euclid ordinance invalid, recognizing, somewhat prophetically that:

In the last analysis, the result to be accomplished is to classify the population and segregate them according to their income or situation in life. The true reason why some persons live in a mansion and others in a shack, why some live in a single-family dwelling, why some live in a two-family dwelling and others in an apartment, or why some live in a two-family dwelling and others in an apartment, or why some live in a well-kept apartment and others in a tenement, is primarily economic. It is a matter of income and wealth plus the labor and difficulty of procuring adequate domestic service.¹³

The U.S. Supreme Court overturned this ruling, however, and upheld Euclid's zoning ordinance as a valid application of the police power.¹⁴ Although not the first local land use case to be tested in the Supreme Court, the decision has been accorded landmark status because it granted federal recognition to the legitimacy of the delegation by states of police power to local communities in matters of land use control. However, this endorsement of "Euclidean zoning" was not categorical, and the appeal could easily have failed. In fact, only two years later another attack on zoning, this time based on the issue of due process of law as embodied in the Fourteenth Amendment, was upheld.¹⁵ However, after this the Supreme Court declined to hear another local land use case for thirty-four years.¹⁶

In the period following the Euclid decision, zoning became accepted as a legitimate power of local municipalities and was widely implemented. Legal battles abounded, but decisions were

⁹ *Ibid.*, pp. 4-5.

¹⁰ *Ibid.*, p. 5.

¹¹ *Ibid.*, sec. 3, p. 6.

¹² *Ibid.*, p. 6.

¹³ *Ambler Realty Co. v. Village of Euclid*, 297 F. 307, 316 (1924).

¹⁴ *Village of Euclid v. Ambler Realty Co.*, 272 U.S. 365 (1926).

¹⁵ *Nectow v. City of Cambridge*, 227 U.S. 183, 48 S. Ct. 447 (1928).

¹⁶ In 1962 the U.S. Supreme Court agreed to hear the case of *Town of Hempstead v. Goldblatt*, 369 U.S. 590 (1962).

by no means all in favor of municipal powers. The concept of zoning was institutionalized, but the courts frequently struck down ordinances when applied to specific lots and plaintiffs.¹⁷ The trend, however, is revealed in *Town of Harrison v. Sunny Ridge Builders* in 1938.¹⁸ In this instance the court upheld an ordinance increasing the minimum lot size from half an acre to one acre while denouncing the use of such measures to limit housing opportunities for the poor. Arguing for equality, the court did not believe that the increase in lot size constituted an impassable economic barrier. Thus, although exclusionary zoning per se was not an issue during these years, devices and techniques later labeled as exclusionary or discriminatory were generally upheld in the courts.

POST-WORLD WAR II ZONING

Although suburbanization is not exclusively a post-1945 phenomenon, after World War II the rate and volume of dispersal of economic activities and residences increased dramatically.¹⁹ As a result, the number of conflicts and legal battles surrounding suburban zoning ordinances increased. Spurred by a desire to preserve the atmosphere of their new communities and anxious to keep taxes down, recent emigrants from central cities began to stiffen their zoning controls and to enact much more stringent and complicated ordinances. With few exceptions these municipal restrictions were upheld. For example, minimum lot sizes of one and two acres were upheld in Massachusetts, New York, and Pennsylvania,²⁰ while lots of up to four and five acres were deemed legitimate in New Jersey, Illinois, and Connecticut.²¹ In a classic case in New Jersey the courts upheld a community's right to set minimum square footage requirements for new home construction.²²

This general trend of support for municipal ordinances continued into the 1960's. In *Vickers v. Township Committee of Gloucester Township* in 1962, for example, the Supreme Court of New Jersey upheld what was, in effect, a total ban on trailer parks in a largely rural community.²³ The court judged that a township need not zone for all types of use and could reasonably exclude an activity that it considered contrary to its overall development plan. This conflicted with an earlier ruling in Michigan in which exclusion of mobile homes was found to be invalid.²⁴ It is, however, the dissenting opinion of Justice Frederick W. Hall in the *Vickers* case that has been accorded landmark status. He argued that "general welfare does not automatically mean whatever the municipality says it does," and later, that "general welfare transcends the artificial limits of political subdivisions and cannot embrace merely narrow local issues."²⁵

¹⁷ For a more detailed discussion of the immediate post-Euclid era, see Babcock and Bosselman, *Suburban Zoning* [see footnote 2 above], pp. 1051-1060.

¹⁸ 170 Misc. 161, 8 N.Y.S. 2d 632 (1938); and a discussion of the case in Haar, *Social Control* [see footnote 2 above], pp. 218-220.

¹⁹ See John F. Kain: *The Distribution and Movement of Jobs and Industry*, in *The Metropolitan Enigma* (edited by James Q. Wilson; Doubleday & Company, Inc., Garden City, N.Y., 1970), pp. 1-43.

²⁰ *Simon v. Town of Needham*, 311 Mass. 560, 42 N.E. 2d 516 (1942); *Dilliard v. Village of North Hills*, 276 A.D. 969, 94 N.Y.S. 2d 715 (1950); and also *Bilbar Construction Co. v. Easttown Twp. Board of Adjustment*, 393 Pa. 62, 141 A. 2d 851 (1958).

²¹ *Fischer v. Bedminster Township*, 11 N.J. 194, 93 A. 2d 378 (1952); *Honeck v. County of Cook*, 12 Ill. 2d 257, 146 N.E. 2d 35 (1957); and also *Senior v. Zoning Commission of Town of New Canaan*, 146 Conn. 531, 153 A. 2d 415 (1959).

²² The case of *Lionshead Lake, Inc. v. Township of Wayne*, 10 N.J. 165, 89 A. 2d 693 (1952) contradicted an earlier ruling in *Senefsky v. Lawler*, 307 Mich. 728, 12 N.W. 2d 387 (1943) and generated its own literature. See Charles M. Haar: *Zoning for Minimum Standards: The Wayne Township Case*, *Harvard Law Rev.*, Vol. 66, 1953, p. 1051; Val Nolan and Frank E. Horack: *How Small a House?—Zoning for Minimum Space Requirements*, *ibid.*, Vol. 67, 1954, p. 967; and Charles M. Haar: *Wayne Township: Zoning for Whom?—In Brief Reply*, *ibid.*, Vol. 67, 1954, p. 986.

²³ 37 N.J. 232, 181 A. 2d 129 (1962).

²⁴ *Degrindee Development Co. v. Charter Township of Warren*, 359 Mich. 634, 103 N.W. 2d 600 (1960).

²⁵ 181 A. 2d 129, 145 in dissent.

DEVELOPMENTS SINCE 1965

Justice Hall's view gained support in the next few years, and 1965 appears to be a turning point for rulings on exclusionary issues. Whether this followed the general societal attitude in the 1960's is unclear, but in several cases suburban zoning ordinances were held to be invalid on a number of grounds. It has been suggested that disillusionment over the outcome of *Brown v. Board of Education*,²⁸ the rising militancy of minority groups and the civil rights movement, and also the composition of the U.S. Supreme Court under Chief Justice Earl Warren led to this change in judicial climate.²⁷

STATE COURT DECISIONS

The major case, which was the forerunner of this new attitude and interpretation, was *National Land and Investment Company v. Easttown Township Board of Adjustment*.²⁸ The Court of Common Pleas of Chester County, Pennsylvania, held Easttown's zoning regulations to be unconstitutional. The Pennsylvania Supreme Court reviewed the case on appeal and upheld the decision of the lower court. The township had enacted an ordinance specifying a four-acre minimum lot size in parts of the community. It argued that this was necessary to allow for proper sewage disposal, to avoid water pollution, to preserve the character of the community and in particular to protect two historic sites. Although the state supreme court noted that "in Pennsylvania zoning for density is a legitimate exercise of the police power,"²⁹ it was not persuaded "that a four acre zone is needed to insure proper sewage disposal and to protect the township water from pollution."³⁰ The justices reduced the case to the two issues of the responsibility of the township to potential in-migrants and the problem of exclusion of smaller and cheaper homes. In answering these points the decision was quite specific.

The question posed is whether the township can stand in the way of the natural forces which send our growing population into hitherto undeveloped areas in search of a comfortable place to live. We have concluded not. A zoning ordinance whose primary purpose is to prevent the entrance of newcomers in order to avoid future burdens, economic and otherwise, upon the administration of public services and facilities can not be held valid.³¹

In writing the majority opinion Justice Samuel J. Roberts was aware of the extent to which the courts were becoming involved in the planning process. Citing earlier cases in Pennsylvania,³² he noted, however, that the court

has become increasingly aware that it is neither a super zoning board of adjustment nor a planning commission of last resort. . . . Instead the Court acts as a judicial overseer drawing the limits beyond which local regulation may not go, but loathing to interfere, within those limits, with the discretion of local governing bodies.³³

Following the *National Land* case, the Pennsylvania Supreme Court declared two- and three-acre lot zoning as unnecessarily large in the *Appeal of Kit Mar Builders* in 1971.³⁴ Justice

²⁸ *Brown v. Board of Education*, 347 U.S. 483 (1954).

²⁷ Richard F. Babcock: *Exclusionary Zoning: A Code Phrase for a Notable Legal Struggle, in Urbanization of the Suburbs* [see footnote 2 above], pp. 313-328.

²⁸ 419 Pa. 504, 215 A. 2d 597 (1965).

²⁹ 215 A. 2d 597, 607 citing *Bilbar Construction Co. v. Easttown Twp. Board of Adjustment*, 393 Pa. 62, 141 A. 2d 851 (1958).

³⁰ 215 A. 2d 597, 608.

³¹ 215 A. 2d 597, 612.

³² For example, *Joseph B. Simon and Co. v. Zoning Board of Adjustment*, 403 Pa. 176, 168 A. 2d 317 (1961); and *DiSanto v. Zoning Board of Adjustment*, 410 Pa. 331, 189 A. 2d 135 (1963).

³³ 215 A. 2d 597, 607.

³⁴ 439 Pa. 466, 268 A. 2d 765 (1971).

Roberts argued once again that zoning was not the appropriate instrument to solve sewerage problems and further expounded on the court's attitude toward parochial views on exclusion.

It is not for any given township to say who may or may not live within its confines, while disregarding the interest of the entire area. If Concord Township is successful in unnaturally limiting its population growth through the use of exclusive zoning regulations, the people who would normally live there will inevitably have to live in another community, and the requirement that they do so is not a decision that Concord Township should alone be able to make.³⁶

It has been noted, somewhat ironically, that large-lot zoning was struck down in this case in favor of one-acre zoning, and that one judge ruled against the ordinance on the taking issue rather than on the basis of exclusion.³⁶

In a related case, the *Appeal of Girsch*, Justice Roberts once more wrote the majority opinion.³⁷ Again citing the National Land decision, the court struck down a total ban on apartment buildings in Nether Providence Township. The dissenting opinion, however, was able to cite numerous cases over the preceding thirty years in which bans on multiple-dwelling units had been upheld in various jurisdictions across the country.³⁸

At much the same time as these decisions were being handed down in Pennsylvania there was a parallel development against exclusionary practices in the neighboring state of New Jersey. *Oakwood at Madison, Inc. v. Township of Madison* was a typical case, decided in 1972.³⁹ Suit was brought by two local developers and six individuals who lived outside the township, on the grounds that one- and two-acre minimum lot sizes limited the availability of inexpensive housing. The case went to the state supreme court, where a lower court ruling was upheld and the ordinance found to be invalid. The decision was clear concerning exclusion, stating in part that

a municipality must not ignore housing needs, that is its fair proportion of the obligation to meet the housing needs of its own population and of the region. Housing needs are encompassed within the general welfare. The general welfare does not stop at each municipal boundary.⁴⁰

In support of the argument that regional housing needs "are a proper consideration of local zoning"⁴¹ the ruling cited *De Simone v. Greater Englewood Housing Corporation No. 1*.⁴² Here Justice Hall, who wrote the landmark dissent in the Vickers case, argued for the majority in approving a zoning variance for the construction of subsidized housing for minority and underprivileged groups in a middle-income area.

The New Jersey case that was hailed as a landmark by open housing advocates arose out of a suit brought by a local chapter of the N.A.A.C.P. against the town of Mount Laurel in 1971.⁴³ Here, the trial court found that the township had unlawfully excluded low- and moderate-income families. The opinion, in part, claimed that Mount Laurel

through its zoning ordinances has exhibited economic discrimination in that the poor have been deprived of adequate housing and the opportunity to secure the construction of subsidized housing and has used federal, state, county and local finances and resources solely for the betterment of middle and upper income persons.⁴⁴

³⁶ 439 Pa. 466, 474, 268 A. 2d 765, 768-769.

³⁷ Babcock, *op. cit.* [see footnote 27 above], p. 319.

³⁸ 437 Pa. 237, 263 A. 2d 395 (1970). This is discussed in Harvey, *op. cit.* [see footnote 2 above], p. 24.

³⁹ 263 A. 2d 395, 402 in dissent.

⁴⁰ 117 N.J. Super. 11, 283 A. 2d 353 (1972).

⁴¹ 283 A. 2d 353, 358.

⁴² *Ibid.*

⁴³ 56 N.J. 428, 267 A. 2d 31 (1970).

⁴⁴ *Southern Burlington Co. N.A.A.C.P. v. Township of Mount Laurel*, 119 N.J. Super. 164, 290 A. 2d 465 (1972).

⁴⁵ 119 N.J. Super. 164, 178, 290 A. 2d 465, 473.

The case went to the state supreme court, where Justice Hall accepted the township's claim that the ordinance was not intended to exclude on the basis of race, origin, or social status but proceeded to rule on the more general issue of the effect of suburban exclusion.

This pattern of land use regulation has been adopted for the same purpose in developing municipality after developing municipality. Almost every one acts solely in its own selfish and parochial interest and in effect builds a wall around itself to keep out those people or entities not adding favorably to the tax base, despite the location of the municipality or the demand for varied kinds of housing.⁴⁶

Citing earlier cases that addressed regional interests as opposed to local concerns⁴⁶ and basing its argument on the principles of equal protection and due process of law in the state constitution, the court required that the township present a comprehensive plan within ninety days with provision for low- and moderate-cost housing. The decision was broadly written to include all communities in New Jersey that practice exclusion and asked for a regional fair-share approach to low-income housing.

The spirit of this decision was continued in 1976 when the state superior court struck down zoning ordinances in eleven communities in Middlesex County, claiming they were unconstitutional and citing the Mount Laurel case.⁴⁷ Although the presiding judge quoted Justice Hall in noting that "courts do not build housing,"⁴⁸ he did argue that some affirmative action was required by the communities. The opinion implemented the fair-share housing concept and actually specified the allocations of low-income housing for which the municipalities had to plan.⁴⁹

Thus proponents of open housing in the suburbs have had considerable success in the state courts. In general since 1965 restrictive ordinances have been struck down in the Northeast, and in some cases the courts have required the construction of a limited number of inexpensive homes.

FEDERAL COURT DECISIONS

Despite the trend in the state courts, open-housing advocates have fared less well in the federal courts, except where blatant racial discrimination has been present. The federal courts have generally avoided local zoning cases, but they have passed rulings in related areas with implications for open housing. In 1969, for example, black residents in Lawton, Oklahoma, were upheld in their claim that zoning practices limited the availability of affordable housing.⁵⁰ A year later a Mexican-American organization was vindicated in its claim that the referendum requirement in California for the proposed construction of low-income housing was discriminatory.⁵¹ Also in 1970, black residents of Lackawanna, New York, sued the city on the grounds of denial of equal protection under the law as guaranteed in the Fourteenth Amendment.⁵² A moratorium on new subdivisions in a predominantly white area and a proposal to zone potential low-income housing sites as open space and parkland was declared discriminatory. The ruling was decided on the basis of Title VIII of the 1968 Civil Rights Act, however, and did not deal directly with zoning practices.⁵³

⁴⁶ 67 N.J. 151, 336 A. 2d 713, 723 (1975).

⁴⁷ See, for example, *Duffcon v. Cresskill*, 1 N.J. 509, 64 A. 2d 347 (1949); and *Cresskill v. Dumont*, 15 N.J. 247, 104 A. 2d 445 (1954).

⁴⁸ *Urban League of Greater New Brunswick v. Mayor and Council of Borough of Carteret*, 142 N.J. Super. 11, 359 A. 2d 326.

⁴⁹ 359 A. 2d 326, 541-542.

⁵⁰ *Ibid.*, at 542 citing 67 N.J. 151, 192, 336 A. 2d 713, 734.

⁵¹ *Dailey et al. v. City of Lawton, Oklahoma*, 296 F. Supp. 266 (W.D. Okla. 1969).

⁵² *Southern Alameda Spanish Speaking Organization v. City of Union City*, 424 F. 2d 291 (9th Circ. 1970).

⁵³ *Kennedy Park Homes Association v. City of Lackawanna*, 436 F. 2d 108 (2nd Circ. 1970).

⁵⁴ The relationship between racial segregation and court rulings on zoning is discussed in Babcock, *op. cit.* [see footnote 27 above], p. 316.

A related case, and one that clearly reveals the exclusionary use to which legitimate zoning tools may be put, is that of *Blackjack*, Missouri. This community, a predominantly white suburb of St. Louis, was chosen early in 1970 by a nonprofit corporation organized by the Methodist church to be the site of a number of federally subsidized townhouses on twenty-five acres of land. These were to be built for black and white families from St. Louis with low to moderate incomes. Within nine months the community had incorporated and instituted a zoning ordinance limiting development to three homes per acre. This action effectively blocked the federally subsidized scheme. Thus the U.S. Department of Housing and Urban Development persuaded the Justice Department to file suit. In federal district court the zoning ordinance was upheld, but the circuit court overturned the ruling in 1974, claiming that *Blackjack's* actions were racially discriminatory and again in violation of Title VIII of the 1968 Civil Rights Act.⁶⁴ The case went to the U.S. Supreme Court, but the justices refused to disturb the appellate court ruling.⁶⁵

Two years after *Blackjack*, the Supreme Court made another decision in a case with apparent implications for the demise of exclusionary suburban zoning.⁶⁶ In *Hills v. Gautreaux* the ruling allowed that federal courts could order low-income housing to be constructed in suburban areas to redress racially discriminatory practices even when the suburbs themselves had not been guilty of such practices. However, the open-housing implications of the Supreme Court ruling were largely illusory. In the first place, although the decision permitted desegregation plans which crossed municipal boundaries, no court orders were issued requiring the implementation of such schemes. Secondly, federal courts have been reluctant to accept any cases that involve local zoning decisions. They have consistently deferred to the states' police power to protect the health, safety, and welfare of the general public through legislation that enables local authorities to enact the zoning ordinances.

In exclusionary cases that did not specifically cite racial discrimination, the courts have not always been sympathetic to the plaintiffs. A significant case was *James v. Valtierra*, in which the U.S. Supreme Court upheld California's referendum requirement for the location and construction of low-income housing projects.⁶⁷ The argument stated that such a requirement did not violate the Fourteenth Amendment and was not racially discriminatory and that if exclusion resulted it was on the basis of income, not race. The Supreme Court reiterated its position on local referenda in *Eastlake v. Forest City Enterprises Inc.*, when, in 1976, it upheld as constitutional the practice of putting rezoning requests up for a local referendum and requiring the approval of 55 percent of the voters before changes could be effected.⁶⁸ This ruling applied to twenty-nine states that had provisions for referenda on local and municipal issues. The decision further reinforced the Supreme Court's position on local control, particularly when issues of the franchise were involved.

A notable exception to the high court's reluctance to review local land use issues was the case of *Belle Terre v. Boraas*.⁶⁹ Here, an upper-income Long Island community interpreted its ordinance requiring single-family homes as sufficient to prevent the occupancy of houses by groups of unrelated individuals. The village was upheld in the trial court, but the decision was reversed at the appellate level. However, Justice William O. Douglas, writing the Supreme Court's decision, reinstated the ordinance as applied and, using language reminiscent of the earliest cases involving exclusion, praised the existence of low-density communities where "family values, youth values, and the blessings of quiet seclusion and clean air make the area a sanctuary for people."⁷⁰

⁶⁴ *United States of America v. City of Blackjack*, 508 F. 2d 1179 (8th Circ. 1974).

⁶⁵ 508 F. 2d 1179 (8th Circ. 1975), cert. denied 422 U.S. 1042, reh. denied 423 U.S. 884.

⁶⁶ *Hills v. Gautreaux*, 421 U.S. 945, 96 S. Ct. 1538 (1976).

⁶⁷ 402 U.S. 137 (1971).

⁶⁸ 96 S. Ct. 185 (1976).

⁶⁹ 416 U.S. 1 (1974).

⁷⁰ 416 U.S. 1, 9. Compare with *Simon v. Needham*, 42 N.E. 2d 316 (1942).

The conservative attitude of the Supreme Court is further exemplified in a recent decision involving the Chicago suburb of Arlington Heights. A suit was filed against the community in 1972 by the Metropolitan Housing Development Corporation, a nonprofit organization working for open housing in the suburbs. The community was upheld in federal district court in 1974⁶¹ but had its ruling overturned by the U.S. court of appeals,⁶² which reasoned that the effect of the zoning ordinance for large lots and single-family homes was discriminatory. The Supreme Court upheld the zoning on constitutional grounds but remanded the case to the appeals court for determination as to whether the community was in violation of the Fair Housing Act, a statutory issue.⁶³ Justice Lewis F. Powell's majority opinion argued that such exclusionary zoning would be in violation of the Fourteenth Amendment only if proof existed that the intent or purpose was racially rather than economically discriminatory. That an ordinance has a "racially disproportionate impact" was not necessarily grounds for striking it down.⁶⁴

It appears that the U.S. Supreme Court will generally review local land use cases only where racial discrimination is claimed but that it now takes a more conservative view than in previous years. A major factor in this decision was the earlier ruling in *Washington v. Davis*,⁶⁵ where it was first stated that a discriminatory result of a program or law was not sufficient grounds for declaring it unconstitutional. The opinion suggested that a "disproportionate impact is not irrelevant, but it is not the sole touchstone of an invidious racial discrimination."⁶⁶ Thus, in general the federal courts have taken a cautious approach to land use controls at the local level, reluctantly accepting some cases and frequently ruling in favor of existing ordinances.

SLOW-GROWTH AND NO-GROWTH ORDINANCES

One area in which state and federal courts appear to agree is the one surrounding slow-growth and no-growth ordinances. Controversy has arisen over these new controls, which have a potential impact on open housing as significant as zoning. Two major decisions, delivered for widely separated locations, New York and California, are of importance. Both cases, one in a state court and the other in the federal system, support the contention that exclusionary devices tied to comprehensive development plans can withstand judicial attack.

In Ramapo, New York, concern over rapid population growth and development led to the acceptance of a comprehensive ordinance in 1969 whereby growth was to be tied to the provision of public services over an eighteen-year period. In essence this was a slow-growth plan. Permits were to be issued to builders on a point system, and as a result developers brought suit based on the taking issue. The township won in the trial court, but at the appellate level the judge ruled in favor of the developers,⁶⁷ only to have this decision overturned by a majority in New York State's highest court in 1972.⁶⁸ The landowner had argued that the purpose of the ordinance was to limit population growth within the town. The New York Supreme Court disagreed and lauded Ramapo for its farsighted planning objectives; however, it did recognize that plans may be used for exclusionary ends.

Although zoning must include schemes designed to allow municipalities to more effectively contend with the increased demands of evolving and growing communities, under its guise, townships have been wont to try their hand at an array of exclusionary devices in the hope of avoiding the very burden which growth must inevitably bring.⁶⁹

⁶¹ *Metropolitan Housing Development Corporation v. Village of Arlington Heights*, 373 F. Supp. 208 (N.D. Illinois 1974).

⁶² 517 F. 2d 409 (7th Cir. 1975).

⁶³ *Village of Arlington Heights v. Metropolitan Housing Development Corporation*, 97 S. Ct. 555 (1977).

⁶⁴ 97 S. Ct. 555, 563.

⁶⁵ 426 U.S. 229, 96 S. Ct. 2040 (1976).

⁶⁶ 426 U.S. 229, 242, 96 S. Ct. 2040, 2049.

⁶⁷ *Golden v. Planning Board of Town of Ramapo*, 37 A.D. 2d 236, 324 N.Y.S. 2d 178 (1971).

⁶⁸ 30 N.Y. 2d 359, 334 N.Y.S. 2d 138, 285 N.E. 2d 291 (1972), appeal dismissed 409 U.S. 1003 (1972).

⁶⁹ 285 N.E. 2d 291, 300.

The ruling went on to argue that the township was exercising its right under state enabling laws to control haphazard growth. Decisive in these court battles was the fact that Ramapo's master plan apparently provided for low- and moderate-income housing. However, it was later revealed that of the low-income units built 75 percent were occupied by the elderly, all of whom were white, while of the fifty units provided for low-income families only between five and ten had ever been occupied by blacks.⁷⁰

A lengthy dissenting opinion by Judge Charles D. Breitel was closer to the hearts of open-housing advocates: "Communities must deal with the problems of population growth. They may not refuse to confront the future by adopting zoning regulations that effectively restrict population to near present levels."⁷¹ The dissent, arguing that holding zones were legally acceptable as long as their duration was fixed and relatively short, held that Ramapo's proposed eighteen-year moratorium was too long.⁷²

A similar set of decisions and appeals was made in the federal courts rising out of the case of *Construction Industry Association of Sonoma County v. County and City of Petaluma* in California. Developers claimed that the city's slow-growth plan, the first in the country, was in violation of the constitutional rights of outsiders to travel and live where they chose. As a result, in U.S. district court the ordinance was struck down.⁷³ The court found the plaintiff's brief convincing. It was argued that Petaluma was attempting to abdicate its responsibility as a member community of a large and growing metropolitan area and to place the burden of housing provision on other municipalities. However, the U.S. court of appeals overturned the ruling late in 1975, citing the Ramapo case and arguing that

the federal court is not a super zoning board and should not be called upon to mark the point at which legitimate local interests in promoting the welfare of the community are outweighed by legitimate regional interests.⁷⁴

Thus, although similar rulings were made in New York and California, they were handed down for different reasons. The New York State court argued that Ramapo was engaged in reasonable long-term planning, whereas in Petaluma the federal court refused to arbitrate an issue of local control. The effect for potential exclusion, however, was essentially the same.

SUMMARY

The evolution of exclusionary zoning can be traced back to early conflicts over land use control at the beginning of the century. After the Euclid decision in 1926, zoning per se became institutionalized and was widely used, ostensibly to promote and protect the general welfare. Exclusionary motives and results emerged after 1945, associated with rapid postwar expansion of the suburbs. In general the courts were sympathetic to the municipalities in their attempts to control land use, to direct development, and to conserve property values. Open-housing agencies began to make headway only in the late 1960's, when a number of exclusionary devices were struck down. After the Mount Laurel decision some observers voiced cautious optimism that the suburbs were about to be opened up to low- and moderate-income housing. A more pessimistic view has been taken in this review. It should be emphasized that exclusionary zoning faced its greatest threat from state courts. These state rulings may be taken as precedent

⁷⁰ F. P. Bosselman: Can the Town of Ramapo Pass a Law to Bind the Rights of the Whole World, in *Land Use Controls: Present Problems and Future Reform* (edited by David Listokin; Center for Urban Policy Research, Rutgers Univ., New Brunswick, N.J., 1974), reprinted from *Florida State Law Rev.*, Vol. 1, 1973, p. 234.

⁷¹ 285 N.E. 2d 291, 308, where Judge Breitel quotes *Concord Township Appeal*, 439 Pa. 466, 474, 268 A. 2d 765, 768.

⁷² See, for example, *Randall v. Snohomish County*, 79 Wash. 2d 619, 488 P. 2d 511 (1971); and *Westwood Forest Estates v. Village of South Nyack*, 23 N.Y. 2d 424, 297 N.Y.S. 2d 129, 244 N.E. 2d 700 (1969).

⁷³ 375 F. Supp. 574 (N.D. Calif. 1974).

⁷⁴ 522 F. 2d 897 at 908 (9th Circ. 1975), cert. denied 96 S. Ct. 1148 (1976).

but are not binding outside their limited jurisdictions. Federal courts have been reluctant to hear local land use cases and have generally taken a conservative position when a ruling was required.

Thus, although certain blatant exclusionary practices may no longer be condoned, recent judicial action has not heralded a new era of open housing in the suburbs. The cases in which zoning was struck down arose from suits filed several years ago. Since then many communities have adjusted to the new judicial climate and have veiled many restrictive ordinances within elaborate development plans, in many cases using environmental impact arguments to support slow-growth and no-growth objectives. Even where fair-share housing allocations have been adopted they have faced legal problems and lack of action at the local level. In most cases the only affirmative action required of municipalities has been for them to present a plan that incorporated mixed-value properties. Suburbs have been encouraged to participate in federal low-income housing programs but have rarely been instructed to do so.

The underlying processes that encourage exclusion as a response to fiscal and social pressures have not been changed by court decisions. It seems likely, therefore, that exclusion in one form or another will continue as long as there is racial and social discrimination and as long as public services continue to be financed substantially from locally generated revenues. Communities will continue to behave in a fashion that approaches economic rationality and attempt to hinder the growth of tax-draining land uses. The problem can be abstracted to one of fiscal control in cities and to the conflict between functional boundaries around metropolitan areas and political boundaries within them.

APPLIED GEOGRAPHY

PREDICTING MICROLEVEL POPULATION CHANGE*

DAVID J. MORGAN and GUNDARS RUDZITIS

SCHOOL boards across the United States have been sensitized to population shifts that have led to decreasing school enrollments. National and local media document decreasing school enrollments in many communities. The question of racial composition of communities and schools has heightened sensitivity to these issues. School administrators are faced with the challenge of managing aging physical facilities, matching faculty size to school enrollments, and developing systematic plans for future school population changes. Because school operating expenses are often matched to enrollments, a sound understanding of enrollment trends is essential. Geographers have the tools and training to provide educational decision makers with sound population change information.

The purpose of this paper is to describe a study of community demographic trends that influence enrollments in a local school district. The members of a suburban Illinois school board needed assistance in answering a fundamental planning question: Is there adequate space to meet future school enrollment demands? The answer to this question would dictate whether a new school would be built with bond money or whether capital improvements would be made in existing structures.

GUIDELINES

The literature that guided our study covers considerations of the homogeneity of small areas and then focuses on the issues of migration that may affect that homogeneity or cause population turnover.

Why homogeneity? The study area is in the southern suburbs of Chicago, Illinois. Given its suburban nature we expected the socioeconomic composition of the community to be fairly homogeneous. The theoretical justification for this homogeneity is derived from what has become known as the Tiebout hypothesis.¹ This hypothesis, itself derived from Samuelson's "pure theory" of public expenditures,² holds that people and firms move in response to the mix of taxes and services they might enjoy. Consequently, an individual will select a location on the basis of the service/taxation mix, assuming perfect mobility and knowledge on the consumer's part about the variances in service and taxing patterns. We observe numerous governmental units in the Chicago metropolitan area that offer differing types and levels of service and taxes; persons will be attracted, according to the Tiebout hypothesis, to each of these by their mix of taxes and services. Because there is a range of places from which the consumer can choose, one should therefore expect a range of persons who seek out various residential areas. Additionally,

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¹ Charles Tiebout: A Pure Theory of Local Expenditures, *Journ. Political Economy*, Vol. 64, 1956, pp. 416-424.

² Paul Samuelson: The Pure Theory of Public Expenditures, *Rev. of Economics and Statistics*, Vol. 36, 1954, pp. 387-389.

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those persons who choose a particular area should have certain characteristics in common because they pick a package that commonly appealed to them. Indeed, we do see, and have seen, documented the homogeneity of suburban areas in general.³

In particular, one of the public services that will vary from place to place is education. Suburbanites are said to enjoy much higher levels of schools than central-city residents.⁴ If people are drawn to a community for its educational qualities, the area may be even more homogeneous.

A primary concern in a study like ours, then, is to obtain an indication of the degree of homogeneity in the study area. If the area is as homogeneous as expected, then our first indication should suggest that little change in school enrollments will occur owing to the apparent stability of the social structure.

The greatest potential change factor in a homogeneous area is migration, for these shifts can occur very rapidly. Migration is clearly more critical than birth or death rates. Death rates have practically no bearing on school enrollments beyond the fact that in-migration can fill housing units vacated by death. Births are critical, but because there is a five- or six-year lead time before their impact on school enrollments, they can be foreseen.

Migration can be influenced by several factors. In almost all studies that have included housing tenure as an explanatory variable, mobility differences have been found between owners and renters. Homeowners are consistently less likely to move than renters.⁵ It has also been shown that, when controlled for age, couples with school-age children have lower mobility than couples with children who are not of school age. Therefore, age of children is a good predictor of mobility.⁶ This finding is substantiated by the fact that young, childless, highly educated, lower-income households are more likely than other households to choose apartments,⁷ and apartment dwellers are also more likely to be more mobile. Because mobility rates are influenced by tenure it is also significant that previous homeownership increases the probability of buying a house rather than renting.⁸ The greater degree to which an area is made up of rental units, the more likely an area is to be affected by migration.

The importance of migration was vividly demonstrated in a neighboring suburb, Oak Park, which experienced very rapid population turnover.⁹ Older families beyond the childbearing stage left Oak Park, while younger families from the adjacent Chicago neighborhood of Austin moved in. As these families moved in, school enrollment jumped dramatically and strained resources severely.

Other phenomena may have to be investigated also. Brian J. L. Berry, for instance, has argued that the migration of blacks to a white community is perceived negatively by whites and

³ See, for example, Edward A. Wynne: *Growing Up Suburban* (Univ. of Texas Press, Austin, 1977).

⁴ Robert L. Lincberry: *Public Services and Economic Development* (paper presented at the Conference on a National Policy Towards Regional Change, I.B.J. School of Public Affairs, University of Texas, Sept. 23, 1977). See also W. L. Hansen and Burton Weisbrod: *Benefits, Costs and Finance of Public Higher Education* (Markham Publishing Co., Chicago, 1969).

⁵ See, for example, Peter H. Rossi: *Why Families Move: A Study in the Social Psychology of Urban Residential Mobility* (Free Press, New York, 1955); Edgar W. Butler, F. Stuart Chapin, Jr., George C. Hemmings, Edward Kaiser, Michael A. Stegman, and Shirley Weiss: *Moving Behavior and Residential Choice—A National Survey*, *Natl. Cooperative Highway Research Program Rept. No. 81*, Highway Research Board, National Academy of Sciences, Washington, D. C., 1968; and Alden Speare, Sidney Goldstein, and William H. Frey: *Residential Mobility, Migration, and Metropolitan Change* (Ballinger Publishing Co., Cambridge, Mass., 1974).

⁶ Larry H. Long: *The Influence of Number and Ages of Children on Residential Mobility*, *Demography*, Vol. 9, 1972, pp. 371-382.

⁷ Robert Schafer: *The Suburbanization of Multifamily Housing* (Lexington Books, Lexington, Mass., 1974).

⁸ Daniel R. Fredland: *Residential Mobility and Home Purchase* (Lexington Books, Lexington, Mass., 1973).

⁹ Pierre De Vise: *Changing Population and Its Impact on Public Elementary Schools in Oak Park, Illinois*, in *Geographic Perspectives on Urban Systems* (edited by Brian J. L. Berry and Frank E. Horton: Prentice Hall Inc., Englewood Cliffs, N.J., 1970), pp. 413-418.

that as black students are assigned to predominantly white schools, white families transfer their children to parochial schools, or move.¹⁰ If this process occurs in Chicago we may find that the socioeconomic characteristics of white in-migrants to the study area are significantly different from current residents. Because the study area is a "first ring" suburb of Chicago and may attract many of the white "leavers," it may be especially vulnerable to the potential migration.

TABLE I—PHASES OF THE STUDY OF MICROLEVEL POPULATION CHANGE

PHASE	OBJECTIVE
1. Analysis of U.S. census block data to construct a demographic base line for at least two points in time.	To compare, in detail, changes over time; to estimate homogeneity.
2. Analysis of real estate turnover and survey of new in-migrants in single-family dwellings.	To project population turnover; to compare new and old residents.
3. Random sample of apartment and townhouse residents of the district.	To compare with new and old residents.
4. Analysis of school enrollment records.	To extrapolate past trends.
5. Examination of the composition and migration plans of the families of children currently enrolled in school.	To analyze school-family population as a subset of the community population; to allow subtraction of the numbers of children who will migrate out of the school system and addition of the numbers of children not yet enrolled in the system.
6. Analysis of the location, size, number, and zoning of vacant land parcels.	To evaluate potential for population growth.

If there are differences then we must ask why, and probe deeper to discover what the future implications may be. For example, to what extent are any differences we may find a response to factors in the inner city? If the analysis reveals no significant differences between in-migrants and current residents, no immediate change in the social structure of the area is expected.

METHOD

In order to collect the data needed to predict population change using analysis of homogeneity and migration, we broke down the problem into six study phases (Table I), each of which would add a unique piece of information to our project. We include here a summary listing of all the phases, followed by a more detailed analysis of each phase.

The U.S. census is the most comprehensive, uniform source of information readily available. However, simple data from published tables are of limited value because they are seldom printed for a specific area of interest; that is, tabulations are not made by school district. Therefore, access to the actual census computer tapes is the most efficient way to aggregate by school district or even, where possible, within individual school attendance area boundaries.

Our strategy in this case was to obtain the census materials and "map" the census blocks into school attendance areas for an in-depth analysis of the 1970 data. The school district comprises five elementary schools, so the census blocks were grouped into five areas whose homogeneity could be compared. Since the block data were available on computer tapes only for 1970, however, we did our 1960-to-1970 comparisons on the basis of census tract data for the two points in time. Although the combined tracts covered a larger area than the actual school district, a cursory base-line comparison was possible.

The census does not provide detailed information on individual property turnover essential to examining population change in an area. To fill this gap we collected data on real estate

¹⁰ Brian J. L. Berry and John D. Kasarda: *Contemporary Urban Ecology* (Macmillan Publishing Inc., New York, 1977).

turnover in the school district. The data included all single-family home transactions, including the date and selling price, which took place between 1967 and 1972. This allowed us to examine trends in selling prices and rates of turnover in single-family dwellings and provided a frame for selecting a sample of recent in-migrants who had purchased single-family homes.

We also gathered data on the distribution of multiple-family dwelling units, both to update the census materials and to serve as a sample frame for the general survey of apartment dwellers. The survey of apartment dwellers, like the survey of the new homeowners, allowed us to collect data on migration attitudes, migration behavior, family size, and so on.

A sizable townhouse community also exists within the school district, and we gathered survey information from the people in this group of residences as well. The three general population surveys—of new homeowners, of apartment dwellers, and of townhouse owners—provided an extensive data base on which to project differential population turnover, because, as discussed above, we expected a good deal of variation in turnover rates by type of residence.

Because our study was done for the school district and was concerned with school enrollments, we analyzed all past enrollment records to discover current enrollment trends, and we also sent surveys home with all children in the district to discover the particular composition of the school families as a subset of the total district population. The study of school families also allowed us to analyze directly the migration plans of these families.

To supplement these population data we also carried out an analysis of the location, size, zoning, and probable development of every vacant parcel of land in the district. Inspection of air photos, land use maps, zoning ordinances, and a land use survey identified potential components of population growth in the district.

SURVEY DESIGN

We surveyed five different groups of people: parents of every elementary school child; parents of every junior high school child (whose family had no elementary school children); a probability sample of apartment dwellers, and surveys of new homeowners and residents in the townhouse development. In each of the five survey groups we collected the following information: age and occupation of respondent; migration plans (in the coming five-year period); if the family planned to move, when the move would take place; date of birth and school attendance plans (public or private) for all children under the age of thirteen; and place and tenure of last residence (townhouse and apartment dwellers only). Additional questions were asked, when appropriate, about former residence, date of moving in, type of residence, and tenure.

The age variable was crucial in comparing the childbearing potential of different groups and as a measure of homogeneity. For instance, we found that the average age of the women in all families who were planning to move out of the district was a little over thirty. The average age of women in all families who were planning to stay, however, was over fifty. The average age of women moving into the district was also about thirty, however, indicating that replacement of childbearing females was taking place.

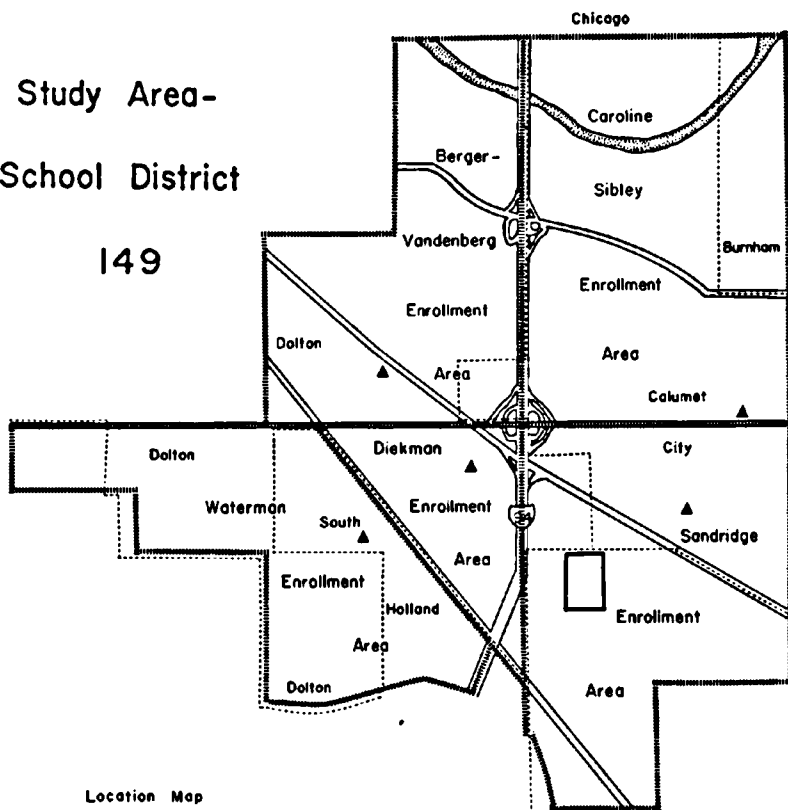
Data on occupation were used as an indicator of socioeconomic status. They allowed us to make statements about the social homogeneity of the area and to compare in-migrants with out-migrants.

Migration was, of course, a key variable in studying the types of people who planned to stay and those who planned to move. It allowed us, for instance, to look for systematic out-migration of large or small families. Because the data also included housing type we could control for the known differential rates of turnover and differential family sizes associated with different kinds of housing.

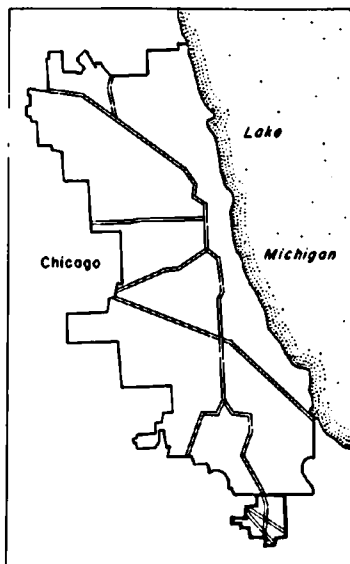
The family data helped us project actual enrollments over the next five years. Because we uncovered preschool children in the surveys and because we knew the family's migration plans, we could add and subtract counts of children from the system; and because we used either a census or a well-drawn sample in every survey, we could make detailed estimates of enrollment changes over time.

Study Area- School District

149



Location Map



Explanation

- ▲ School
- School Enrollment Area
- City Boundary
- Part of Diekman Enrollment Area located inside the Sandridge Area

FIG. 1

Included in the family data was a question about whether the family planned to send the child to a parochial or public school. Because the district contains some large and fairly well supported private schools, we wanted to be sure we did not overlook a potentially large

TABLE II.—SAMPLE DESIGN FOR THE SURVEY OF APARTMENT DWELLERS

STEP	PROCEDURE
1.	List the address of every apartment building with four or more apartment units and record the number of units. This would probably be done during the land use survey.
2.	Assign a random number (from any random number table) to every building.
3.	Sort the list by the random numbers into ascending order.
4.	Now sort the list by increasing size of building, maintaining the previous order in each of the new categories.
5.	Further sort the list by school attendance area in ascending order while maintaining the order of the two previous steps. You now have a list ordered by size of building and school attendance area which is a stratified list of clusters of apartment buildings.
6.	Now take the random list of buildings in every other school attendance area (starting with the second) and reverse the order so that buildings are ordered from largest to smallest. In groups of equal-sized buildings the random numbers should be in descending order. (This step eliminates systematic bias owing to regularities in building sizes among school attendance areas.)
7.	Pick a random number from one to four ($1/4 = 25$ percent sample) and pick that apartment building and every fourth building after that. These make up your sample buildings.
8.	Send field teams to every selected building to record the names of persons living at that address for survey mailing.

influence on school enrollments.

Recall that out-migration from Chicago placed a severe strain on suburban school enrollments in Oak Park. We wanted some estimates of the sources of new migrants into our study area and hence included the question on place and tenure of last residence.

The surveys of all elementary school children's families and of residents of the townhouses were actually censuses—an attempt to obtain information on every family in the population. The survey of junior high school student parents (who had no children in elementary school) and the survey of new homeowners were also censuses. The apartment dwellers' survey was, technically, a 25 percent clustered, stratified random sample of families in apartment units (buildings of four or more apartments) in the school district (Table II).¹¹ The sample was stratified by school attendance area (five strata) and, within attendance area, by absolute size (number of apartments) of the building.

THE STUDY SETTING

The school district we studied is located in southern Cook County, Illinois. The district falls in parts of four suburbs on the southern border of Chicago and contains five elementary schools and a junior high school (Fig. 1). As is the case in many places, school district boundaries, or attendance areas, do not coincide with census or municipal boundaries.

In 1970 the total population of the district was 26,292, and total enrollment in the schools was approximately 4,500. The average resident of the district was a high-school graduate with an income of about \$12,000 (district median). The median housing value was about \$22,000, and the majority of the housing was built in 1960. Renters made up 23 percent of the population, and the median rent was about \$145 a month. Furthermore, about half of all employed

¹¹ See Leslie Kish: *Survey Sampling* (John Wiley and Sons, New York, 1965); and W. G. Cochran: *Sampling Techniques* (2nd edit.; John Wiley and Sons, New York, 1963).

TABLE III—CHARACTERISTICS OF RESIDENTS OF THE STUDY AREA
(In column percentages)

CHARACTERISTIC	GROUPS OF RESIDENTS		
	Elementary school parents	New in-migrant homeowners	Apartment dwellers
Occupations of Males			
Professional, technical, and kindred	13.4	15.6	15.3
Managers and administrators (except farm)	11.5	7.3	9.3
Sales workers	8.0	8.6	7.9
Clerical and kindred	3.6	4.5	4.7
Craftsmen and kindred	37.7	35.8	33.0
Nontransport operatives	8.3	10.1	9.8
Transport operatives	7.6	7.6	7.9
Nonfarm laborers	6.9	7.8	9.3
Service workers (except private households)	3.0	0.0	0.0
Private household workers (includes housewives)	0.0	2.8	2.8
Farm service	0.2	0.0	0.0
BASE NUMBER	1,999	400	215
Mean Age (in years)			
Male	38.3	45.0	42.1
Female	35.3	43.0	41.3
Family Size			
1	0.0	2.4	41.1
2	1.7	24.9	38.0
3	11.5	22.9	13.4
4	32.5	24.9	5.2
5	29.7	15.0	1.8
6	15.1	6.9	0.5
7	6.0	2.2	0.0
8	2.4	1.0	0.0
9	0.7	0.2	0.0
10	0.3	0.0	0.0
11	0.1	0.2	0.0
BASE NUMBER	2,165	493	382
Migration Plans			
Move in next five years	11.2	12.1	63.2
Stay	88.8	87.9	36.8
BASE NUMBER	2,178	481	351

residents commuted to their place of work in Chicago. Minority groups were an insignificant proportion of the population: in 1970 there were only 34 black residents and 74 persons of other races in the district. In all, a picture emerges of a white lower-middle-class suburban area which currently does not have to deal with the issues of an expanding minority population.

RESULTS

Across all the population groups we studied, including families of children currently enrolled, new homeowners in the district, and a random sample of apartment dwellers, we found few differences in any of the demographic factors we asked about, allowing for the different kinds of housing of the respondents (Table III). Because few differences existed, and because current trends were maintaining relative social homogeneity, we concluded that there were no demographic shifts unfolding that would tend to change enrollment trends in the future.

An example of the demographic stability we found is reflected in the occupations of men. There were no significant differences in the types of jobs held by apartment dwellers, new in-migrant homeowners, or fathers of currently enrolled pupils. Although the people in the various housing types were in various stages of life, it is remarkable that, despite housing differences, they tended to have the same general types of employment.

There were differences, however, in the ages of men and women living in apartments versus those who had recently purchased homes. There were also differences in family sizes between

TABLE IV—DEMOGRAPHIC MEANS FOR ELEMENTARY SCHOOL FAMILIES MOVING AND STAYING

VARIABLE	MEAN FOR MOVERS	MEAN FOR STAYERS
Occupational prestige score of fathers	42.3	40.7
Occupational prestige score of mothers	31.0	29.2
Age of fathers	36.3	38.6
Age of mothers	32.8	35.6
Size of family	4.4	4.8

these groups. However, when we examined the variances in detail, we could attribute them only to the types of housing they lived in (apartment versus single-family dwellings), rather than to any social factors. Thus these differences are to be expected even in an area as homogeneous as this one.

Although there were no appreciable demographic variances in the population, there were strong differences in migration plans. These also varied by housing type, as we would expect. Recent in-migrants who had purchased homes were much less likely to plan to move out of the area than were apartment dwellers or residents of townhouses. However, when we looked at the demographic characteristics of the public school families who did plan to move, compared with those who did not, we found no statistically significant differences (Table IV). That is, because the "leavers" are the same types of people as the "stayers" and apparently also as the "newcomers" (and, especially, because they have about the same sizes of families), the net result will be no major demographic shifts. The similarity between the distribution of occupations among elementary school fathers and among new in-migrant males who purchased homes, for instance, was great (Table III). Because the new in-migrant male homeowners are replacements as well as additions to the population base, it is evident that there is little difference between these new arrivals and the current population. Similarly, the differences between the families of school children who are planning to stay and those who are planning to leave are relatively small. Despite the arguments of "white flight" and declining central-city populations, then, our study area does not seem to have received any substantial impact from out-migration from Chicago.

One problem, which was not directly a subject of our study, was brought to light by our analysis of the five school attendance areas within the school district. This is the problem of differential turnover rates by school. One of the schools, Sandridge, will experience relatively more turnover than any of the other schools.

This is a direct result of the different types of housing available in the several school attendance areas. Apartment dwellers, especially in buildings of seven or more units, and townhouse residents are the two groups with the highest projected mobility rates. Therefore, while the Sandridge School area will experience an "average" rate of single-family turnover, it has a high percentage of large apartment buildings (87 percent of all of the apartments in buildings with ten or more apartments) and almost all of the townhouses, and turnover will be high because of the mobility of people in this type of housing. Although the rates of turnover are high, the net change, as we said above, will probably be small in terms of demographic profiles.

Sibley, another of our five schools, will also experience more turnover than the other schools because it contains more apartment buildings than the other areas (81 percent of all units in 5-to-9-unit apartment buildings). The Dickman School area will also experience some apartment

turnover, whereas Berger-Vandenberg and Waterman School areas will have almost no apartment turnover because they have few apartments in their areas.

If this kind of continuous turnover is considered a possible problem for educational goals, any future redistricting of the school attendance boundaries, for whatever reason, should be made with a view toward equalizing the number of large apartment buildings, thus distributing the turnover.

Our demographic analysis led us to the conclusion that there are no significant demographic changes that could affect school enrollments occurring in the district. Our analysis of school records showed that the number of graduating students has been increasing slightly. However, kindergarten enrollments will show a general downward trend over the next five years, although there may not be a decline in each of those years.

Of course, graduations cannot continue to increase and kindergarten enrollments decline unless there are influxes of students in the middle grades. This influx is not likely to happen, given past experience. Graduations will eventually decline as the kindergarteners who enrolled in the past five years move through the grades.

In order to estimate the magnitude of future enrollments we counted the number of students who will be coming into the system in the next few years (Table V). The numbers represent actual counts and are minimum enrollments if the demographic trends remain stable, as is currently indicated. The figures for the 1980/1981 year are not reliable because 1975 was only about a third complete when the survey was done and, of course, many 1975 births came later in the year. The trend is generally downward, and we expect the minimum number of students enrolling in kindergarten to decrease. This means that overall school enrollments will decrease as well.

However, we did not account for all children expected to come into the district in the next five years because we only surveyed recent in-migrant homeowners, rather than counting every single homeowner, new and old. The new in-migrant homeowners make up a tenth of all homeowners in the district. If we assume that they are representative of the total single-family dwelling unit population, then we can simply multiply the counts of children reported by our survey by ten to get an estimate of their contribution to total future enrollments (Table VI). Again, the 1980/1981 year is underestimated, but we still see a general downward trend in enrollments. These figures have a larger possible variance, however, because of the multiplication by ten. Also, the estimates will be different from what actually occurs if the recent in-migrant homeowners have relatively few or relatively more children than the rest of the homeowners. Because our other analyses showed that the new in-migrants were much like the out-migrants, we would not expect any differences, however.

One of the major concerns of our study was to assess whether there would be a need for additional pupil space to meet future enrollment growth. Based on these data our answer was no. Even if these estimates are off by as much as 25 percent in any one year, none of the schools is likely to become overcrowded (if an average of more than thirty pupils per room is defined as being crowded). The only potential problem is at Dickman School, which is close to that level now, but allowing for graduation to Dirksen Junior High School there should be no problem.

Our estimates do not include any future development in the district. The majority of the vacant land suitable for residential development is located in the Sibley, Sandridge, and Dickman school attendance areas. Given past population growth (1960 to 1970) as indicated by census data and field survey of the area, we expect that future growth will be concentrated in the Sibley and Sandridge areas and that new development must be carefully monitored to anticipate new growth. We also found no evidence to suggest that the development of single-family dwellings in the school district deviates from national patterns of inflation and lending rates, so that monitoring can follow national trends to some extent. Consequently, we strongly recommended that the district, on a yearly basis, monitor changes in housing construction as indicated by the number of housing permits that are issued. In this way rough estimates of the additions to school enrollments can be taken into account, using the procedure outlined below.

TABLE V—POSSIBLE MINIMUM ENROLLMENTS, BY SCHOOL, BY YEAR

YEAR	BERGER-VANDENBERG	SIBLEY	DIEKMAN	SANDRIDGE	WATERMAN	TOTAL
1975/1976	65	64	53	45	29	256
1976/1977	58	69	36	62	30	255
1977/1978	48	43	26	65	21	203
1978/1979	26	25	33	36	17	137
1979/1980	18	37	20	24	9	108
1980/1981 (partial)	3	12	0	3	2	20
TOTAL	218	250	168	235	108	979

TABLE VI—POSSIBLE FUTURE ENROLLMENTS ASSUMING NEW HOMEOWNERS HAVE FAMILIES SIMILAR TO OTHER SINGLE-FAMILY HOMEOWNERS, BY SCHOOL, BY YEAR

YEAR	BERGER-VANDENBERG	SIBLEY	DIEKMAN	SANDRIDGE	WATERMAN	TOTAL
1975/1976	83	82	88	45	56	354
1976/1977	67	105	72	107	48	399
1977/1978	66	61	26	65	30	248
1978/1979	62	34	51	63	35	245
1979/1980	63	100	29	60	27	279
1980/1981 (partial)	39	21	0	3	2	65
TOTAL	380	403	266	343	198	1,590

If we combine the type of new development with our accumulated knowledge from the various surveys of the types of families likely to reside in such housing, estimates of their potential additions to the various attendance areas can be made. The important criterion to consider is whether these changes have a significant impact on decision making and planning in the district. If there is excess capacity in the schools, these additions may not impose any excess burdens on their ability to accommodate the additional students. On the other hand, if a school such as Diekman, which is near capacity, has increased enrollments from new development, action may need to be taken, even if it is just a matter of adjusting boundaries to distribute pupils more equally in the district.

Now let us examine future enrollments based on current development and present a technique for estimating enrollments given any level of construction activity. First, to get an indication of current development we estimated the number of building permits issued in the district during the past five years. This period was chosen to coincide with our vacant-land survey in order to exclude those buildings already under construction when the survey was taken. The building permits were summed by school attendance area, except that information on construction in the Waterman School area could not be retrieved from the city's records in that area. In all of the other areas, we counted a total of forty permits, twenty-four of which were in the Sandridge area and seven of which were in the Sibley area. This is evidence of the potential for development of the Sandridge and Sibley areas mentioned earlier.

There are differences in the types of current development by attendance area, however. In Berger-Vandenberg and Diekman the permits are solely for single-family dwellings, and there are nine of them. In contrast, no permits were issued for single-family homes in the Sibley area, and the Sandridge area had a mixture of housing types.

By examining the characteristics of the types of families now residing in similar kinds of structures we can estimate, by school attendance area, the number of children expected from these additions (Table VII). In the Sandridge area in the fall following our study, enrollment would increase by an average of twelve and a half children, and eight more preschool children would enter in the next five years. Thus, based only on construction activities during the study

period, the projected increase from these new developments was trivial.

The factors used in making these calculations were derived from an analysis of the various surveys. We know how many children are presently enrolled in school and how many are of preschool age in each of the types of housing. If we divide the total number of enrolled or preschool children by the total number of families, we obtain an enrolled or preschool ratio. To

TABLE VII—ESTIMATED NUMBER OF ADDITIONAL NEWLY ENROLLED AND PRESCHOOL CHILDREN BY TYPE OF RESIDENCE AND SCHOOL ATTENDANCE AREA

TYPE OF RESIDENCE	SCHOOL ATTENDANCE AREA*				
	BERGER-VANDENBERG	SIBLEY	DIEKMAN	SANDRIDGE	TOTAL
Additional Newly Enrolled Children					
Single-family dwelling	2.3	0.0	2.8	7.4	12.5
Multiple-family dwelling	0.0	3.0	0.0	5.1	8.1
TOTAL	2.3	3.0	2.8	12.5	20.6
Additional Preschool Children					
Single-family dwelling	1.2	0.0	1.5	3.9	6.6
Multiple-family dwelling	0.0	2.4	0.0	4.1	6.5
TOTAL	1.2	2.4	1.5	8.0	13.1

* No data were collected for the Waterman School area.

calculate the number of additional enrolled children from single-family homes we multiply the number of homes currently under construction by 0.57, the ratio of children to homes for recent in-migrants in single-family homes. The ratio for preschool children is 0.30. In the case of multiple-dwelling units, we multiply the total number of units in buildings being built by 0.10 and 0.08 to get the total number of enrolled and preschool children expected from these buildings.

These factors can be used in making predictions based on changes in the amount of development, when the number of permits issued is known. For example, let us examine a hypothetical case. Suppose we know from an inspection of building permits issued during a year that rapid development is going to take place in one of the school attendance areas. The development taking place in this example consists of 100 new single-family homes and a combination of multiple-dwelling units that contain a total of 300 units. Using the factors shown above we can calculate the number of children who will be enrolled the following fall, and in the next five years. Given this rapid development there will be an increase of 57 children from single-family dwellings and 30 from multiple-family dwellings in the affected school the following fall, a substantial increase. Then, over the next five years, an additional 54 children (30 from single-family dwellings and 24 from multiple-family dwellings), on the average, will enter this particular school. Consequently, this example shows that substantial development can have a considerable impact, whereas if development proceeds according to the present pattern, the effect of new developments will be relatively minor.

Given the factors used in determining Table V, the district should be able to project future enrollments from new development if they monitor future construction in the area. One way to do this is to periodically review the number of building permits issued within the district.

SUMMARY

We set out to provide local school authorities with information that would direct the expenditure of a million-dollar bond program. Using the procedure outlined above, the school district decided against building any new facilities to accommodate future population growth.

Correspondence with school district officials since the study has revealed that our base-line projections underestimated total enrollment by about 10 percent. Our projections (Table VI) showed that some 1,001 students should have enrolled in 1975/1976, 1976/1977, and 1977/1978. The district reports that 1,128 actually enrolled during that period. However, our projections could not include new student enrollments owing to new construction in the area after the study period. We provided rates of growth attributable to new housing construction in the area but advised the district that they should update the tables as new housing was actually constructed and occupied. Therefore, if new construction that was completed and occupied during the projection period had been added to our base projections, the error would have been reduced.

Another purpose of our study was to provide a methodology that the district could replicate and update. Larger districts can develop and analyze their own studies, but we saw a critical part of our task to be the development of a system which a small staff could replicate. It is particularly important that this be done in population projections because of the potential increases from new construction. Consequently, we prepared a manual which provides step-by-step procedures for replicating all phases of the study, thus enabling the district to plan more accurately for future needs. In so doing, we demonstrated that many of the techniques familiar to geographers can be usefully applied to problems of public policy making.

THE AMERICAN GEOGRAPHICAL SOCIETY

THE Society has entered a new era. The AGS Collection and *Current Geographical Publications* have been transferred to the University of Wisconsin-Milwaukee; two major grants have fueled the launching of the Society's new programs in New York; and the *Geographical Review* has a new Editor.

A recapitulation of the events that led up to the move to Milwaukee is contained in the *AGS Newsletter*, which is distributed to the Society's Fellows. Suffice it to say here that in the final weeks of our two-year effort to obtain legal approval for the transfer of the AGS Collection, cooperation between state and city officials and the Society was so effective that the matter was handled entirely "on papers," with no court hearing. The Society's legal counsel and a representative of the Attorney General's office submitted the new petition and related documents to the New York State Supreme Court on July 25, and Justice Oliver C. Sutton approved the petition the following day.

The move itself was accomplished with unusual efficiency and smoothness. UWM officials, led by Gerald C. Hock, AGS Move Coordinator, guided a team of expert packers and movers so well that the last of the sixteen moving vans left New York less than a month after the transfer was approved. The challenge of the move is staggering; according to William C. Roselle, Director of the UWM Library, "This doubtless is one of the largest library moves, involving transfer of title of ownership, in our nation's 200-year history." Because of the magnitude of the move, service to users of the AGS Collection will necessarily be suspended for several months.

For the ten remaining staff members at the Society's headquarters in New York, the doldrums of the past two years are already a memory. Early in 1978 the Andrew W. Mellon Foundation and the National Geographic Society each awarded the Society a grant of \$100,000, contingent upon the transfer of the AGS Collection to Milwaukee. The first installments of those grants have enabled the Society to move briskly toward initiating its new programs, as outlined in my Annual Report to the Council (published in the July, 1978, *Geographical Review*). The first business seminars are being organized, and the first research contracts are being sought. In order to devote my full energies to these and other Society activities, I have relinquished the editorship of the *Geographical Review*. The journal is now in the capable and experienced hands of Dr. Douglas R. McManis, who formally became Editor on September 1, 1978.

Dr. McManis is uniquely well qualified for the editorship. He received his bachelor's and master's degrees in geography from Kent State University and his doctorate, also in geography, from the University of Chicago. He taught at several universities, and was most recently on the faculty of Teachers College, Columbia University. One of the nation's foremost historical geographers, Dr. McManis is widely known for his numerous articles, for his monographs on "The Initial Evaluation and Utilization of the Illinois Prairies, 1815-1840" (*University of Chicago, Department of Geography, Research Paper No. 94*, Chicago, 1964) and on "European Impressions of the New England Coast, 1497-1620" (*University of Chicago, Department of Geography, Research Paper No. 139*, Chicago, 1972), for his "Historical Geography of the United States: A Bibliography" (Division of Field Services, Eastern Michigan University, Ypsilanti, 1965), and, most recently, for his "Colonial New England: A Historical Geography" (Oxford University Press, New York and London, 1975).

In the past few years Dr. McManis has devoted prodigious amounts of his time and energy to the Society, all as a volunteer. He has served as Book Review Editor of the *Geographical Review* since 1974 and as Secretary of the Society since 1976. We are honored and delighted to have him join the staff.

—SARAH K. MYERS

GEOGRAPHICAL RECORD

AUSTRALIA'S WATER RESOURCES: A SECOND REVIEW. More than a decade has passed since the publication of the first overall assessment of Australia's water resources ("Review of Australia's Water Resources [Stream Flow and Underground Resources], 1963" [Dept. of National Development for the Australian Water Resources Council, Canberra, 1965]; noted in *Geogr. Rev.*, Vol. 57, 1967, pp. 567-569). In addition to consolidating available data, the "Review" stressed the limited supply of water resources, the lack of knowledge concerning them, and the consequent problems in terms of their management. Subsequent years have emphasized many of these matters.

Many parts of the country, particularly South Australia and the western parts of New South Wales and Victoria, are currently in the grip of severe drought. Production of livestock and crops, notably wool and wheat, has been significantly cut ("The Australian Agricultural Economy: Annual Review 1977-78," in National Agricultural Outlook Conference 1978: Papers Presented [Bur. Agric. Econ., Australian Govt. Publishing Service, Canberra, 1978]); and, although large water storage and supply systems spare most of Australia's urban population the severe consequences of drought, during these periods demand far exceeds input in Adelaide and Perth (J. H. Holmes: *Water Resources of Australia and the Pattern of Population Concentrations*, *National Population Inquiry Research Rept. No. 4*, Australian Govt. Publishing Service, Canberra, 1976). In addition, ground-water inflow, saline discharge from irrigation areas, and concentration through evaporation affect the quality of available water supplies in certain areas ("River Murray Working Party Report to Steering Committee of Ministers, October 1975" [Australian Govt. Publishing Service, Canberra, 1976]). In the Mildura District of Victoria, for example, irrigation water from the River Murray deposits five tons of salt during the growing season on each hectare of irrigated land, according to estimates published in the *Journal of the Institution of Engineers Australia* (Vol. 49, 1977, No. 29, p. 11). By the time the river water reaches South Australia, even higher salinity levels create severe problems for irrigation areas and for Adelaide, which has the poorest-quality water of all Australia's major cities. Numerous instances of flooding in recent years and, on a smaller scale, storm-water runoff from urban and rural areas also contribute significantly to pollution of streams. Together with pollution from unsewered areas and with plant nutrients in the discharge from sewerage works, this is becoming a major problem in the Sydney area of New South Wales ("The Quality of Sydney's Natural Waterways in Relation to Its Growth" [N.S.W. State Pollution Control Commission, Sydney, 1977]).

Considerable federal funding available since 1967 for quantitative data collection and a water-quality assessment program inaugurated in 1975 have resulted in the adoption of 244 areas as river basins. These are grouped into twelve drainage divisions. The "Review of Australia's Water Resources 1975" (Australian Water Resources Council/Dept. of National Resources, Australian Govt. Publishing Service, Canberra, 1976) shows the number of gauging stations increased from 1,439 in 1963 to 3,710 in 1975. The gauged area, however, still accounts for only 46 percent of the estimated average annual discharge, and only 37 percent of the continent is covered. Northern and central Australia and the South Australian Gulf manifest a particular lack of coverage.

Australia has not only the lowest precipitation and runoff, in proportion to its area, of all the continents but also the lowest percentage of runoff to precipitation—87 percent is lost by evapotranspiration. Moreover, the average annual runoff of about 45 millimeters varies across the continent, with less than 5 percent having more than 250 millimeters and with 26 percent of the country's area contributing 88 percent of total runoff. The high evaporation rates and variability of stream flow make conservation and development of surface water resources in Australia more costly and less effective than in most parts of the world. In many locations, it is only possible to build wide, shallow storages in which the evaporation problem can be particularly acute, in terms of both water losses and the quality of the water that remains.

Ground water is the main source of water for the arid half of Australia. Major sedimentary basins underlie 60 percent of the continent. Water quality varies considerably. In the Great Artesian Basin, which underlies 22 percent of the continent, most of the water has the great advantage of being fresh in areas where, if there is any surface water, it is usually brackish or saline. In addition to the "outback," a number of smaller areas rely on ground water for irrigation and for industrial and domestic uses. These areas account for about 40 percent of all withdrawals.

The possible exploitable yield of total runoff of fresh and marginal water, which is 94 percent of the total runoff of all water, amounts to 39 percent, ranging from just over 20 percent in northern Australia to 83 percent in the Murray-Darling Basin. Some 24 percent of the possible exploitable yield (only 9 percent of the total Australian runoff) is committed. According to the 1975 "Review" there are three reasons for this low overall commitment: the country's economic resources are by no means fully developed; many potential developments that are technically feasible are not economic for topographic or climatic reasons; and the bulk of the resources are remote from the centers of population around Australia's southeast coast. The precarious position of Adelaide and most of South Australia can be further illustrated by the fact that although nine of the twelve drainage divisions have commitments of less than 24 percent, for the Murray-Darling Basin the figure is 91 percent. These figures present an incomplete picture, however, for water commitment figures still exclude nonconsumptive uses. In Tasmania alone, almost $10,000 \text{ m}^3 \times 10^6$ of water are committed annually for generation of hydroelectric power, compared with $1,722 \text{ m}^3 \times 10^6$ for all other purposes.

The constraints and vagaries of the physical environment necessitate considerable investment in water-storage schemes, but they also require water-resources policy and management of the highest order. Until quite recently, waste, pollution, and maladministration have been more in evidence (B. W. Davis: *Water Resources, in Public Policy in Australia* [edited by R. Forward; Cheshire Publishing Pty. Ltd., Melbourne, 1974]). The Ord River Irrigation Scheme in the Kimberley district of Western Australia ("Ord Irrigation Project, Western Australia: An Outline of Its History, Resources and Progress". [Dept. of National Resources, Australian Govt. Publishing Service, Canberra, 1976]), the Shoalhaven Scheme, which added to Sydney's supplies of stored water at the cost of inundating part of Morton National Park ("The Shoalhaven Scheme," *Sydney Water Board Journ.*, Vol. 26, 1976, No. 2, pp. 2-10), and the Dartmouth Dam, under construction on the Mitta Mitta, a tributary of River Murray, in Victoria to improve the quantity and quality of water supplies for South Australia ("An Evaluation of the Dartmouth Dam" [Dept. of the Environment and Conservation, Australian Govt. Publishing Service, Canberra, 1974]) are but a few of the projects that have caused many people to question the prevailing methods of managing and developing Australia's water resources.

But the situation is changing. At the state level, new administrative organizations with wider legislative powers have been created. The 1975 "Review" observes that "water management is no longer seen just in terms of storing water and regulating streams for consumptive use, but also in terms of conserving unregulated streams in an unmodified landscape for wildlife preservation or recreation purposes, or for possible social or economic use by future generations."

The federal and state governments have recently adopted "A National Approach to Water Resources Management" (Australian Water Resources Council, Canberra, 1977), which reflects these gradually changing attitudes. Because the federal government may have the financial resources while the states have the constitutional responsibility for water resources, the document further provides a basis for cooperation on all aspects of water resources matters between the two levels of government. An interesting sidelight to the policy statement was the 1976 revision of the objectives and functions of the Australian Water Resources Council (the intergovernmental forum), the major change being the addition of water management to the Council's existing concern with water resources assessment and research (*AWRC Activities 1976*

[Australian Water Resources Council/Dept. of National Resources, Australian Govt. Publishing Service, Canberra, 1977]).

Australia's history and development have been greatly influenced by the nature and extent of the continent's water resources. This is still true, and will continue to be so. However, it is perhaps still equally true to say that Australia has a greater shortage of good water management than of good water. Virtually no consideration, for example, has been given to demand management, but up to 50 percent of water supplied to Australian cities is used for watering gardens, and Sydney, with a reservoir capacity more than four times its annual consumption, continues to expand its supply system. As the Minister of National Resources observed in the Foreword to *AWRC Activities 1976*, "the development of better techniques of planning and management are essential if we are to make the best use of our resources."—PETER CRABB

GEOGRAPHY APPLIED TO HUMAN HEALTH. Medical geographers as well as geographers in the fields of water resources, air pollution, biogeography, soils, and agricultural geography can find appropriate research suggestions in "Human Health and the Environment—Some Research Needs: The Report of the Second Task Force for Research Planning in Environmental Health Science" (*DHEW Publ. No. NIH 77-1277*, U.S. Dept. of Health, Education, and Welfare, Washington, D.C., 1977). The report identifies "a substantial number of major and urgent issues to which the nation's research resources in environmental health should be directed over the next few years."

Of particular interest to geographers are the chapters on "General Atmospheric Pollutants," "Food, Water, and Multiple Resources," "Selected Problems of Special Environments: Neighborhood, Home, Hospital, Etc.," "Physical Environmental Factors," and "Transport and Alteration of Pollutants, Waste Disposal, and Natural Sources of Toxicants." The chapters contain an introduction or a general statement of problems in the field under consideration as well as extensive bibliographies. Most important, however, are the hundreds of suggestions for specific research projects. Many of these numbered recommendations can be investigated by geographers working in conjunction with specialists in other areas, for the task force encourages interdisciplinary research. Recommendation 6-12, for example calls for geological as well as geographical expertise: "Geographic areas in which domestic waters and produce are known to contain anomalous amounts of naturally occurring metals which originate from rock structures in the same area should be mapped. These maps would provide a basis for comparing these data with statistics on diseases, such as cancer and heart disease."

Geographers with an interest in atmospheric pollution can help identify specific pollution sites—areas of sulfur oxide pollution that are likely to have significant changes in degree of exposures, for example. Sites with pollution from nitrogen oxides need to be identified even if they are outside the United States. Another recommendation calls for the identification and study of populations chronically exposed to local pollution by metals and metalloids. Geographers interested in a more comprehensive research problem related to air pollution can assist in a study of allergy control. This recommendation (number 1-25) calls for research on the cost of aeroallergen control programs and on defining factors that determine the geographical extent and kinds of land to which controls must be applied.

The chapter on food and water as well as several other sections of the report will intrigue agricultural geographers, biogeographers, and physical geographers. Basic research is needed to measure the level of toxicants intrinsic to food plants, taking into account plant variety, growing area, climate, and soil conditions. Studies of poisonous plants and the grazing habits of livestock are needed to determine those plant toxins most likely to contaminate meat, milk, and eggs. Research is recommended to determine sources of certain kinds of contamination of food crops and whether such contamination takes place during harvest, transport, or storage. Geographical concentrations of certain metals and their interactions and availability to mammals should be studied.

The report will also appeal to those geographers who specialize in water resources. The

study of toxic metals in municipal sewage and the development of methods to cope with urban runoff are recommended for research. A profile of the sources and relative amounts of organic toxicants in surface and ground-water supplies is needed. Other suggestions relate to the study of ground-water transport of pollutants and the interaction of trace chemical pollutants and thermal discharge into water bodies. Land disposal sites for industrial wastes and requirements for the location and operation of such sites are the subject of other recommendations.

Several recommendations relate to noise pollution. Among these are a call for refinement and standardization of noise environment characterization and monitoring. Noise criteria for land use compatibility and studies of hospital noise are also suggested.

A few recommendations related to total human health may interest social and political geographers. Called for are studies of local community contingency management. The principles of these systems, behavioral studies of people in such communities, and studies of new experimental model communities of varying social and cultural backgrounds are suggested for research efforts. These recommendations emphasize systematic direct observation, hypothesis formulation, manipulation of critical variables, and study of the consequences. In the chapter on "Environmental Forecasting and Technology Anticipation," the task force states that critical elements in evaluating the environmental impact of technology are "changes in geographic patterns of population distribution which may affect exposure patterns from industrial effluents. New population distributions also become important determinants of industrial activity, power distribution, modes of disposal of wastes, etc. Demographic patterns and trends should be viewed as variables in environmental forecasts."

In addition to suggesting specific research needs, the report recommends changes in data gathering, in data analysis, and in forecasting techniques, which may interest geographers whether or not they participate in health-related research. For example, the task force desires inclusion of new questions in the census. Data on smoking and other characteristics of the population are suggested to identify variables strongly related to disease occurrence in relatively small areas such as counties. The report also recommends the establishment of a national clearinghouse to catalog sources of information on current and past environmental exposure levels for various geographical areas of the United States, to assess the quality and representativeness of environmental exposure data, and to provide to users with information concerning the availability and applicability of the data. Finally, the report recommends more attention to data analysis in health research rather than data accumulation. Data accumulation is necessary, but research proposals should include adequate provision for data analysis.

In summary, the "Report of the Second Task Force for Research Planning in Environmental Health Science" is an important document for geographers who are concerned with health care. Those in other specializations will also find research and perhaps funding opportunities in the report.—JAMES W. FONSECA

MEETING OF THE ASSOCIATION OF AMERICAN GEOGRAPHERS. Approximately half of the paid-up members of the Association of American Geographers assembled in New Orleans for the seventy-fourth annual meeting of the Association, April 9–12, 1978, when three thousand odd geographers converged on the Crescent City to enjoy creole charm, cajun cooking, and vice versa. Some awesome statistics reveal that the meeting has become much too large to be digested by any single individual, no matter how diligent: 2,360 preregistrants, more than the total registration for any previous meeting of the Association; 1,420 names in the printed program; 510 papers on Monday, 174 on Tuesday morning, 350 on Wednesday, and 19 more in a special all-day AAG-IGU coastal symposium on Thursday; 224 sessions of papers; 25 field trips, with room for 938 participants and hundreds more complaining bitterly because they could not be accommodated; and 7 workshops. Robert C. West and Clarissa Kimber, cochairpeople of the Program Committee, did a yeoman job of organizing and arranging this inchoate mass into a cohesive program that ran with no perceptible hitches.

The management of the Hyatt Regency Hotel, where the meeting was held, might well have

taken lessons from the Program Committee. The hotel registration desk made blackstrap molasses look like a paragon of speed and efficiency, and the hotel elevator system apparently was designed to make even the front desk look good by comparison; there was time enough to form lifelong friendships while waiting for an elevator. If an elevator finally arrived, those on the north side gave an indescribable view of the changing form of the Superdome—surely a surplus cooling tower squashed into its present shape beneath the heel of some bayou Paul Bunyan—as seen through a dizzying lattice of rhomboidal trapezoids, or whatever it is that holds up the ends of the Hyatt Regency. The southside elevators provided an equally dizzying vista of the astonishing melange in the vast hollow center of the hotel, where what appear to be bits of debris from a disintegrating space capsule dangle in midair between balconies decked with the Hyatt's answer to the hanging gardens of Babylon. In defense of the hotel, let it be said that morning coffee was free in the lobby, bedspreads were neatly turned down at vespers, and chocolate-covered mints appeared on pillows at bedtime.

Geographers eager to quit the confines of the Hyatt Regency discovered that the Local Arrangements Committee, ably chaired by H. Jesse Walker, had laid on a truly remarkable range and variety of field trips, including traverses of the Yucatán, the western Gulf Coast, the lower Mississippi Valley, the Atchafalaya Basin, and Bayou Lafourche; thematic trips that ranged from agriculture and architecture through black neighborhoods, cemeteries, churches, industrial development, oil and gas fields, port activities, shipyards, space laboratories, and urban problems to wetland areas; and of course a paddle-wheel cruise on the Mississippi. All of the field trips were oversubscribed almost immediately; nearly five hundred persons applied for one of the forty places on the no-cost trip to a Chevron drilling rig. The lucky forty discovered that there is no such thing as a free lunch, or at least not for long, because most of them paid the price to a rough and choppy sea.

The increasing vocational concern of geographers was reflected by workshops on job opportunities, student internship programs, and undergraduate career options, which augmented workshops in more traditional areas such as remote sensing, data in medical geography, and peasant agriculture. Many participants organized their own private nocturnal excursions in order to apply their sharp observational skills and keen analytical techniques to close examination of the dynamic oscillations and kinetic vibrations for which the French Quarter is famous.

Registrants at the meeting were handed a bulging plastic portfolio into which the Local Arrangements Committee had crammed a veritable treasure trove of useful material, including a 336-page volume of abstracts of papers, a field guidebook of 138 pages, a lagniappe of helpful information about the city and state, and a fascinating compilation of material related to the 37th annual meeting of the Association, which was held in Baton Rouge December 27–31, 1940.

The opening session on Sunday evening, beautifully orchestrated and chaired by H. Jesse Walker, was a welcome harbinger of a superbly well organized meeting. James M. Coleman, Director of the Coastal Studies Institute at Louisiana State University, presented a brilliantly illustrated introduction to the Mississippi Delta. William G. Haag, Professor of Anthropology at Louisiana State University, described six millennia of human activities in Louisiana with his customary charm and wit, and showed strangers why he is held in such high affection by all who know him. Sam B. Hilliard set mouths watering when he concluded the evening with an affectionate discourse on food and drink in Louisiana.

Tuesday afternoon was given over to plenary sessions in the Regency Ballroom. President Melvin G. Marcus presided with grace and dignity at the session when honors were bestowed upon members of the Association who have distinguished themselves by their services to the profession and by their scholarly activities. An Association paperweight was presented to John S. Adams in appreciation for his services as secretary of the Association and his efficient chairmanship of its Long Range Planning Committee. Donald J. Patton, retiring editor of the *Professional Geographer*, was presented with a paperweight and a complete bound set of the volumes he edited. Fred B. Kniffen was cited "for his formative role in the development of

the cultural geography of the United States through his devotion to material culture and the humanized landscape." A. William Küchler was cited "for his long-term contributions to biogeography, and indefatigable devotion to world-wide vegetation mapping." Allan Pred was cited "for original scholarship in the fields of urban, economic, and historical geography, and for his contributions to the specialized study of city systems."

Harold M. Rose, past president of the Association, chose "The Geography of Despair: An Assessment of the Rising Incidence of Lethal Violence," as the subject for a data-packed Presidential Address that required close attention. He said that the homicide rate in the nation has increased since 1960. This increase has been variously attributed to wartime experiences that sanctioned killing, to an increase in the proportion of the population aged 15 to 24, to the greater availability of handguns, to a reduced threat of punishment, to a loss of respect for social institutions, to increased consumption of alcohol and drugs, to the influence of violence on television, and to interregional migration.

Rose said that homicide victims are predominantly black and male; blacks are nine times more likely than whites to die an untimely death. The notion of a black subculture with a propensity toward interpersonal violence cannot be validated, he said, but it is a useful explanatory construct. The nation has a high proportion of black young people, because the baby boom after World War II reached higher levels and remained higher longer among blacks than among whites. Homicides are concentrated in the larger central cities, and in a small number of "homicide environments" of increased stress in inner cities where blacks are concentrated. Rose concluded with a plea for geographers to pay more attention to the geography of crimes of violence and to environments of violence and despair.

At the annual business meeting following the Presidential Address, President Marcus announced that irregularities in the mailing of ballots had led him to take the unprecedented step of announcing the vote cast for each of the three candidates for vice-president. The new officers of the Association are Brian J. L. Berry, president; John Fraser Hart, vice-president; Richard L. Morrill, secretary; and Lawrence A. Brown and Janice Monk, councillors. Thomas J. Wilbanks continues to serve as treasurer.

President Marcus said that the work of the Long Range Planning Committee has been the most important activity of the Association over the past year. Although there is no way to please all of the members all of the time, he said, we may anticipate some significant breakthroughs. He reported that Executive Director J. Warren Nystrom will retire on July 1, 1979, and that an active search is under way for a replacement.

Executive Director Nystrom reported that Association membership grew rapidly from 1963 until 1973, but it has declined slowly since 1973, and a continued decline must be anticipated. Most of the dropouts have been student members, he said, but the Association must focus its attention on faculty members who have dropped out.

Thomas J. Wilbanks reported that the financial condition of the Association has been greatly improved by an increase in overhead from funded projects, by the recent increase in dues, by a major reduction in publication costs, and by the fact that the Association made money on its 1977 meeting in Salt Lake City. The 1978 budget is balanced, he said, but storm clouds lie ahead: 1) dues will not keep the budget balanced if costs continue to rise; 2) the Long Range Planning Committee wants more money spent on services; and 3) the Association has relied excessively on overhead from research projects.

John S. Adams delivered a brief but impressive report on the work of the Long Range Planning Committee, which has operated through six task forces partially supported by a grant of \$10,000 from the National Geographic Society. A full report has been made to the Council, action on recommendations is under way, and detailed reports will appear in the *Newsletter* and the *Professional Geographer*.

Feminism appeared to have replaced Marxism as the Cause of the Year when the establishment-dreaded hour for "other business" finally arrived. The Committee on the Status of Women Geographers had announced its intention of proposing a resolution requiring the

Association to boycott states that have not ratified the Equal Rights Amendment to the Constitution, but declined to present it because the Council had already passed a similar resolution at its Sunday meeting. This adroit parliamentary ploy sowed temporary chaos and confusion in the ranks of the opposition, but eventually the customary motion to refer the action to a mail ballot received more than the necessary fifty votes. The business meeting then passed a motion affirming support of the Council resolution by a vote of 158 to 77.

Mei-Ling Hsu (chair), Truman A. Hartshorn, and David Simonett were elected to the 1979 Nominating Committee, and Peirce F. Lewis (chair), George H. Dury, and Leslie J. King were elected to the 1980 Honors Committee.

The 75th Anniversary Meeting of the Association will be held at the Ben Franklin Hotel in Philadelphia, April 22-25, 1979, with J. R. Mather chairing the Program Committee, Peter Muller in charge of local arrangements, and Peter Rees in charge of field trips.

The New Orleans meeting was permeated by a remarkable cajun-like mood of *camaraderie*, good cheer, happiness, and relaxation, in sharp contrast to the tension and restlessness of some recent years. Even the atmosphere in the meeting rooms was clearer than it has been in years past. Apparently more and more geographers have begun to heed the warning of the Surgeon General, and thank their lucky stars that his strictures have not yet graced glass bottles. The imbibitional behavior of geographers in New Orleans reflected their keen environmental concern, and their awareness that those who drink Mississippi River water have a high incidence of cancer.

The seafood motif was carried over into the paper sessions; some of the meeting rooms were so miniscule that geographers were packed into them like sardines. Given the number of concurrencies—a single afternoon in New Orleans could have accommodated all of the papers presented at the 1971 meeting in Boston—attendance at most sessions was remarkably good, in part because damp and gloomy weather discouraged exploration of the marvels of the Crescent City, at least during the day, and in part because the lobbies had almost no place to sit. Anyone tired of standing was virtually compelled to attend a paper session, but the rewards were ample, because the quality of papers presented in recent years has been increasing just as steadily as their quantity.—JOHN FRASER HART

GEOGRAPHICAL REVIEWS

ECCENTRIC SPACES. By ROBERT HARBISON. 177 pp.; notes, index. Alfred A. Knopf, New York, 1977. \$8.95. 9 3/4 x 6 1/2 inches.

Robert Harbison is one of those fortunate people for whom time, circumstances, and ability combine to allow the imaginative contemplation of places and landscapes, so harried and family-encumbered tourists like me must be grateful to him for indicating what we have missed in our travels. Although there is much in "Eccentric Spaces" for intellectual sightseers, the book is really a personal and evocative essay about the pleasures of environmental experience. The author's aim is to consider how we domesticate the spaces and landscapes that we encounter by penetrating them with our imagination.

Environment and space can mean many things; for Robert Harbison they are aspects of a world that is experienced as a work of art, although not in the extreme sense that every object, however ugly, warrants our aesthetic attention. The environments of this book consist of those that have delighted the author, especially man-made spaces both built and fictional. They are indeed "eccentric spaces," away from the mainstream interests of architects, art historians, geographers, and tourists, yet somehow appropriate to all of these. They include the Boboli Gardens, the living room of Sherlock Holmes, nineteenth-century railway stations, Venice, Bruegel's paintings, and the London Underground.

The unconventional mixture of this sampling may suggest that "Eccentric Spaces" is little more than a random assortment of descriptions and musings, but there is a subtle coherence given to the argument by a progressive attempt "to assimilate more and more to the realm of delight." Our imagination takes what we know to be physically real, transforms and elaborates it, and gives it atmosphere and meaning; but imagination also takes what we know to be invented and gives it a substance that we scarcely doubt. Harbison explores this continuum of imagination by reflecting on the meanings of gardens, on rooms as expressions of our personalities, on streets as images of communities, and on the landscapes of Gothic novels. Maps he sees as wonderful achievements in miniaturization that bring the landscape indoors and condense human spaces in a way that is almost transcendental, even as they maintain contact with reality. Museums and their catalogs, by defying time and grouping artifacts in all sorts of improbable combinations, provide the most concentrated sources for imaginative speculations and are mystical spaces in which all things strive to happen all the time.

This book does not have an easily summarized or classified line of argument, for it is about Robert Harbison's sense of things and places and his search for order in the imaginings that these generate in his mind. It is a book that is rich in ideas and insights, and it is unquestionably based on considerable scholarship. Nevertheless, I have some problems with "Eccentric Spaces," perhaps because it is unconventional and neither a work of formal scholarship or intended for a wide audience. Sometimes the author seems to lose his sense of purpose, and then the style drifts into an unnecessarily obscure type of art history in which familiarity with works of art and their artists and critics is casually assumed. I also found an insufficient background for many of the examples, and as a result it is difficult to appreciate Harbison's subtle interpretations, unless you happen to have some direct or vicarious experience of the spaces and places that he is describing. In this respect illustrations and photographs would have greatly enhanced the book, but there are none of these. I could find further, more specific points of criticism, but I am inclined to look favorably on writing that proceeds from the author's experience rather than from some arbitrary but familiar disciplinary perspective. However, I am well aware that others less predisposed than I may well find the whole book aimless, insubstantial, and annoying.

If you suspect that geography is an enormous act of imagination and invention, then this book has much to offer. It is an ingenious exploration of some of the sources of topophilia, and it is also a demonstration of the wealth of possibilities that lie in subjective interpretations of

particular places and may serve to indicate an alternative to the rather abstract approaches to the experience of space and place recently adopted by some geographers. If you have an adventurous nature, even though you may not be prepared to abandon the supposition that geography really exists, then take "Eccentric Spaces" on your next European vacation; it will lead you to fascinating places both famous and obscure, and it could prove to be the key to the doors of your geographical imagination.—TED RELPH

NATIONALITY AND POPULATION CHANGE IN RUSSIA AND THE USSR: An Evaluation of Census Data, 1897–1970. By ROBERT A. LEWIS, RICHARD H. ROWLAND, and RALPH S. CLEM. xxxiii and 456 pp.; maps, diagrs., bibliogr., index. Praeger Publishers, Published in Cooperation with the Program on Soviet Nationality Problems, Columbia University, New York, 1976. \$27.50. 9¼ x 6¼ inches.

Focusing on the ethnic dimension of the population of the Soviet Union, "Nationality and Population Change in Russia and the USSR" provides the most comprehensive analysis to date of demographic, geographical, and socioeconomic trends of the principal nationalities in the Soviet population. The unifying theme of the book is the universality of the process of modernization as it relates to population change in pluralistic societies. Specifically, the authors attempt to show that the population of the Soviet Union, notwithstanding its distinctive ideology and political-economic system, has manifested patterns of demographic behavior in response to the socioeconomic forces of modernization basically similar to those of other countries. What makes the study of modernization and population change in the Soviet Union so noteworthy, however, is the enormous ethnic diversity of its population. As the authors note, practically every aspect of Soviet society and development has been and is to some degree determined or shaped by ethnicity. The important contributions of this work are an analysis of the differential effects of modernization on the multiethnic population of the Soviet Union and an assessment of the consequences on Soviet society.

The study is an analysis of demographic and socioeconomic data from the Russian census of 1897 and the Soviet censuses of 1926, 1959, and 1970. The perplexing problems of utilizing Russian-Soviet population data for comparative purposes are dealt with by the authors in a reasonably satisfactory manner. The nineteen major economic regions of 1961 were chosen as the basic territorial units for the study. The data for the censuses of 1897, 1926, and 1959 were organized into eighteen matrices, each containing approximately fifty to a hundred demographic and socioeconomic variables for each region. Data from the 1970 census were utilized to the extent they were available at the time of publication. The data were then subjected to a number of statistical analyses, including factor analysis and rank correlation analysis.

The results of these analyses show that the population of the Soviet Union has undergone modernization at an extraordinarily rapid pace, but with significant variations in degree among various ethnic groups. The Russians, because of their dominant political position, and the Tatars and what the authors call "Mobilized Europeans"—Jews, Armenians, Georgians, Estonians, and Latvians—because of their cultural traits that include a strong achievement orientation, have been affected by and have most benefited from the modernization process. In the three principal indices of modernization, urbanization, spatial mobility, and population growth rates, these nationality groups displayed the basic characteristics of modernized societies elsewhere in the world. In contrast, other ethnic groups, especially those in Soviet Central Asia, remained the least urbanized and spatially mobile while they maintained the highest rates of natural increase.

As a consequence of the differential impact of modernization on the multiethnic society of the Soviet Union, the authors found that stratification of nationalities on socioeconomic lines, begun in Tsarist times, has actually intensified and that in spite of impressive economic development, "almost all non-Russian nationalities have actually lost ground relative to the Russians in socioeconomic levels." These conclusions not only tend to confirm the authors'

fundamental hypothesis regarding the universal character of the demographic and socioeconomic processes in multiethnic societies but also are a resounding indictment of the failure or, perhaps more accurately, the futility of established Soviet nationality policies.

In the final chapter the authors integrate their findings with existing theories of ethnic processes and modernization into a conceptual framework that serves as the basis for an assessment of the future of the nationality problem in the Soviet Union. Based on the contention that the universal experience of modernization in multiethnic societies, modernization actually accentuates rather than diminishes ethnic identity and competition, the authors predict that continued economic development, urbanization, mobility, and population growth will result in substantial redistribution of nationalities, greater ethnic mixing, and increased ethnic tension. Specifically foreseeable is a massive migration of the rapidly expanding Turkic-Muslim population in Central Asia to the more developed areas of the western portion of the Soviet Union. The Turkic-Muslim migrants, because of lower levels of skills and education, will be forced into the bottom rung of the occupational structure in the predominantly Slavic region. If the prediction becomes reality, the strains on Soviet society could indeed become great.

A particularly noteworthy feature of the book is the summary provided at the beginning of each chapter. The arrangement facilitates the reader's analysis and evaluation of the data and arguments put forward by the authors. The extensive bibliography (of both Russian and English sources) should facilitate further exploration of the particular themes developed in the book. On the other hand, the book would have benefited considerably from a greater number of maps. The relative paucity of maps appears surprising because so many of the authors' findings lend themselves readily to cartographic representation.

Although analysis of demographic trends in the Soviet Union and synthesis of the literature on modernization and ethnicity are the substantive contributions of the work, its most distinctive feature is the masterful weaving together of the varied and complex demographic, geographical, and socioeconomic processes that collectively shaped the Soviet Union and its society as we have come to know them. Seldom have the operation and interrelationships of these basic dimensions of society been delineated with such clarity as in this work.—THOMAS FEDOR

URBANIZATION UNDER SOCIALISM: The Case of Czechoslovakia. By KAREL JOSEPH KANSKY. 313 pp.; maps, diagrs., bibliogr., index. Praeger Publishers, New York, 1976. \$23.50. 9½ x 6½ inches.

Karel Kinsky has produced one of the most detailed and comprehensive studies available in the West of the process of urbanization in a socialist country. He states that the study is largely descriptive in nature, but in fact he has attempted a fairly sophisticated level of numerical analysis of various aspects of Czechoslovak urban development. Many of the aspects of Eastern European urban development and urban life that are familiar to those who have visited these countries are analyzed in some detail, with well-documented arguments backed by statistical evidence.

The author does more than simply examine the Czechoslovak situation. He compares Czechoslovak housing standards, population growth, and urban development with those in other socialist and nonsocialist countries. Although much of the book is multidisciplinary, geographical analyses predominate. A number of maps and diagrams support the text.

The book begins with a historical review of Czechoslovak urbanization and a discussion of major internal and external influences. It is unfortunate that Kinsky uses the term "geopolitical externalities" when he means external social, cultural, economic, and political ideas. The word "geopolitical" conjures up somewhat different connotations. These external ideas include the concept of the European medieval city, industrialization, and Western European, Hapsburg, and Soviet influences. He points to the important role of the Germans in the diffusion of

the concept of the medieval town and town-building skills in Czechoslovakia, but he sees the present state of Czechoslovak urbanization as controlled by influence from the Soviet Union.

One of Kansky's most interesting discussions concerns the housing problem. He documents the chronic shortage of housing, probably the most serious of Czechoslovak social problems. Although destruction of residential housing in Czechoslovakia during World War II was minimal in comparison with that in other Eastern European countries such as Poland, the authorities have never been able to handle effectively the housing of the population. New apartment blocks have arisen in many cities since the war, but much of the housing remains obsolete and deteriorated. Slovakia, historically the least-developed region of the country, has received more emphasis in housing construction than other areas, and "do-it-yourself" housing has been encouraged with some positive results. In Bohemia and Moravia the construction of cooperative apartments has been more popular, and in some cases factories sponsor this type of housing. However, judged by almost any standard, housing is poor. The needs and preferences of the individual family are not taken into account by an inefficient bureaucracy. Kansky is rather verbose in his discussion of the inefficiency of party-state government in dealing with urban and housing problems. But his discussion of the principles and concepts of planning is useful.

After a review of the numerical data on urban growth and rank-size distribution, Kansky focuses on several topics. He thinks that one of the fundamental principles of socialist urban planning is the idea that cities are simply bases for industrialization and no more, a view that results in a simplistic view of urban development. Kansky elaborates on this point to present a general theory of socialist urbanization, including a very formal set of definitions, axioms, and theorems that reads like the abstract or proposal of a doctoral dissertation. His theory is interesting, but seems too abstract and on the whole an unsatisfactory explanation of the actual trends and development of modern socialist urbanization.

Kansky is both articulate and penetrating in his summation of findings and his discussion of future trends. He links past urban development, low rate of population growth, lack of housing, inefficient bureaucracy, and influence exerted by the Soviet Union as the major factors in an explanation of present urbanization trends in Czechoslovakia. Future optimum-development of cities will not be insured simply by solving the housing crisis. He argues that bureaucracy must be decentralized and that a local urban market, geared to the requirements of individual residents, must be established. Kansky prefers to allow the development of a balanced rank-size distribution of cities, but he admits that the external influence of the Soviet Union results in a continued emphasis on higher levels of urbanization in some regions of the country than in others. Any changes in the present trends of urbanization in Czechoslovakia will occur with now-unlikely changes in the political system.

Kansky provides much useful material, and he analyzes aspects of socialist urbanization that have been observed and commented on but rarely have been so well documented. But the major value of his book perhaps is the vistas of future studies that he has opened. On the whole, the book is a useful contribution in an area of great interest to all involved in the study of urbanization.—IAN M. MATLEY

MANUFACTURING: A Study of Industrial Location. By E. WILLARD MILLER. xii and 286 pp.; maps, diagrs., ill., bibliogr., index. The Pennsylvania State University Press, University Park, Pennsylvania, 1977. \$16.50. 9 1/4 x 6 1/4 inches.

This volume is designed to present a theoretical and an empirical foundation for the study of industrial location. The attention given to theory is substantial when the book is compared with Professor Miller's earlier work, "A Geography of Manufacturing" (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1962). It should be a useful instructional tool for a variety of college courses that deal with economic geography generally and manufacturing specifically.

The book is divided into three parts and each has a list of selected references. Part I is

entitled "Industrial Location Theory," and its eighty pages deal with such topics as least cost theory, spatial general equilibrium, and Soviet industrial location theory. It is clear that the author feels that theory developed to date may have some utility as a frame of reference, but it remains deficient as a means to explain real-world industrial locations. He recommends relaxation of the rigid assumptions associated with classical partial and general equilibrium theory and reasonably suggests use of behavioral theory.

Part II deals with "Factors of Industrial Localization" in a somewhat different treatment than is commonly presented. Market, materials, labor, capital, and other items are called primary factors, while physical environment, government policies, taxes, and management are considered secondary factors. A section entitled industrial growth includes such subheadings as economies of scale, technological innovation, and geographical concentration. The concluding section of Part II focuses on models for regional analysis. Professor Miller covers most of the matters commonly associated with an understanding of industrial localization, but he does so in a manner that some readers may find a bit inefficient. Little is made of the traditionally accepted difference between smaller scale location factors and larger scale site problems. I am a bit troubled too by the author's notion that "although primary and secondary location factors are determinants in initial location decisions, they do not explain . . . why industries flourish or decline." A careful reading of Part III seems to contradict this notion, as should be the case.

Part III is a "Locational Analysis of Selected Industries" that focuses on American industries such as iron and steel, motor vehicles, and petroleum refining, all of which have national and international dimensions. The basic thesis expressed is that "the ability of a manufacturing industry to exist and expand will depend on being located where a satisfactory combination of locational factors exist."

A number of books have appeared in recent years on the subject of manufacturing geography and industrial location. Their emphasis ranges from theory, to explanatory descriptions of existing manufacturing activity, to how-to-do guides for industrial developers. Professor Miller's newest effort, by virtue of the breadth of its approach, brings together a blend of useful materials.—JOHN H. THOMPSON

A CAPITAL FOR CANADA: Conflict and Compromise in the 19th Century. By DAVID B. KNIGHT. xviii and 341 pp.; maps, diagrs., ills., bibliogr. *The University of Chicago, Department of Geography, Research Paper No. 182.* Chicago, 1977. \$6.00. 9 x 6 inches.

CHOOSING CANADA'S CAPITAL: Jealousy and Friction in the 19th Century. By DAVID B. KNIGHT. xi and 228 pp.; maps, bibliogr. McClelland and Stewart Limited. (The Carleton Library No. 105.) Toronto, 1977. \$4.95 (Can.). 7 x 4½ inches.

When a capital city is chosen, a state selects both an administrative site and a node of national life. The process of selection thus engenders deep emotions, a circumstance particularly noticeable when the choice is part of the merger of separately organized and functioning political units. The designation of a frontier lumber town, Ottawa, to be the capital of the United Canadas in 1857 is a classic demonstration of a conflict in which a host of political factors were interwoven.

In 1841 Canada consisted only of those parts of Ontario and Quebec within the Great Lakes-Saint Lawrence watershed. The two former colonies, so different in language, religion, economy, history, and external relationships, were united by the British government into a single province with one legislature. The two former capitals, Quebec City and Toronto, were at opposite ends of the axis of population and transportation, and, in any case, a severe cultural dichotomy virtually precluded either of them from being the permanent capital of the new province.

The result was a stultifying lack of consensus. Within twenty-four years the capital function was moved no less than six times among five cities! For modern times this must surely be the ultimate example of a perambulating capital. The key decisions at the beginning and the end of

the process were made in London, on the advice of the governors general. Centrality (defined in many ways), ethnic prejudice, transportation, military defense (vis-à-vis the United States), finances, the availability of local facilities, amenities, and the principle of compromise all played their part in the movement of delegates, civil servants, records, and the Queen's own representative (the governor general) from Kingston to Montreal to Toronto to Quebec to Toronto to Quebec to Ottawa. Perhaps the critical factor was an unforeseen event, the Montreal riots of 1849, during which a Tory English-speaking mob burned down the parliament building and stoned the carriage of the then Governor General, Lord Elgin.

Finally the financial and personal costs caused by the continuing change of capital led to an appeal to the Queen for a permanent site. Victoria accepted the advice of her Governor General, Sir Edmund Head, in favor of the compromise site, Ottawa, but the decision proved so unpopular that it was first refused, and then accepted only because of the enormous moral power inherent in a Royal decision.

This fascinating history has been told in two new books by David B. Knight. The two volumes cover the same story in slightly different ways. The larger of the two, "A Capital for Canada," is Knight's doctoral dissertation in monograph form. It includes an extensive bibliography and a short résumé in French. "Choosing Canada's Capital" is a collection of documents with explanatory narrative.

Each book is organized chronologically, but the framework is more obvious in the monograph, which deals with events almost on a day-to-day basis. The central thread of the work is the ceaseless series of parliamentary debates and votes on the capital issue. No less than sixty-eight maps of voting patterns are included. It reads much like a suspense serial, although there is the danger of tedium as one proceeds from crisis to crisis. The monograph ends with a summary on "Themes and Patterns." Here Knight pulls together the questions of "images and attitudes" and of "indicators of territorial attachments." The final seven maps are composites culminating in a map of "city support regions."

"Choosing Canada's Capital" is shorter and avoids the day-by-day progression that is both the strength and the weakness of the monograph. The chronology is capsulized around certain key events. The aim of the book is "to make available a selective compilation of materials relating to the seat of government issue. . . ." The book is divided into nine chapters; each has an introduction that summarizes the events of a particular period, and extracts of varied length from contemporary sources such as government papers, reports, speeches, or editorials. In the first chapter, a section labelled "Some Themes" duplicates many of the conclusions to be found in the other book's "Themes and Patterns." Thus "A Capital for Canada" tells the story and then produces a set of conclusions, whereas "Choosing Canada's Capital" gives the conclusions (themes) at the outset, and shows through documentary evidence their role in the selection process. To most scholars the latter work may be more satisfying, but unfortunately its bibliography is selective.

For students of Canada's national problem, the books offer the ancillary reward of a host of quotations dealing with English-French relations of a century ago. The arguments brought into the open many of the prejudices of the time, particularly the Ontario view of Quebec as "the headquarters of Romanism," "with its horde of semi-civilized, priest-ridden habitants. . . ." The initial choice of Kingston was based partially on a governor general's view that the French members should be introduced to "English ideas. . . and the working of English habits."

Because both works grew directly out of a dissertation, the author could not allow himself the freedom of pursuing speculative questions. Yet to a contemporary Canadian the consequences of the Montreal riots of 1849 almost inevitably lead to "what if" considerations. If they had not occurred, the capital functions would probably have remained in Montreal, and where then Separatism?

Even though one could hope for more fully developed conclusions, the details of the process of selection make these books valuable. Combined they present a full discussion of an administrative choice that dealt with a combination of virtually every possible locational factor.—

ANDREW F. BURGHARDT

COLONIAL URBAN DEVELOPMENT: Culture, Social Power and Environment. By ANTHONY D. KING. xvi and 328 pp.; maps, diagrs., ills., bibliogr., index. Routledge & Kegan Paul, Boston and London, 1976. \$17.50. 9¼ x 6¼ inches.

If the process of urban development associated with European expansion in Asia and Africa is to be adequately understood, studies of the unique sociocultural forms produced by imperial contact must be initiated before they are completely neutralized by the relentless forces of nationalism, urbanization, and modernization. The need for such studies was recognized during the 1960's when certain writers demonstrated the inadequacy of conventional theoretical tools for investigations of the colonial city. Led by Janet Abu-Lughod (*Tale of Two Cities: The Origins of Modern Cairo, Comparative Studies in Society and History*, Vol. 7, 1965, pp. 429-457; and *Cairo: 1001 Years of the City Victorious* [Princeton Univ. Press, Princeton, N.J., 1971]), some scholars concluded that most cities in realms of Western dominion were dualistic entities subsuming indigenous and alien elements and reflecting deep social, economic, and political cleavages between rulers and ruled. Predictably, these persistent discontinuities found clear expression in the physical and functional separation of the pluralistic communities in colonial towns and cities.

Such cultural composites seemed to defy analysis in terms of urban typologies familiar to Westerners. It was especially apparent that Gideon Sjoberg's then-popular dichotomization of cities according to the primary prescriptive measure of technological inheritance (*The Preindustrial City: Past and Present* [Free Press, Glencoe, Ill., 1960]) failed to account for the distinctive heterogenetic centers established by Europeans along the African and Asian littorals. Recognizing the limitations of a simple bifurcated image of urban society, T. G. McGee called for articulation of a discrete model of the colonial city and for systematic study of representative places (*The Rural-Urban Continuum Debate: The Preindustrial City and Rural-Urban Migration, Pacific Viewpoint*, Vol. 5, 1964, pp. 159-181). In thoughtful responses Ronald J. Horvath (*In Search of a Theory of Urbanization: Notes on the Colonial City, East Lakes Geogr.*, Vol. 5, 1969, pp. 69-82) and Carville V. Earle (*Reflections on the Colonial City, Hist. Geogr. Newsletter*, Vol. 4, 1974, pp. 1-17) attempted to particularize the distinguishing features of colonial urbanism, but their efforts failed to produce adaptive models or formal theories to undergird future investigations.

Publication of Anthony D. King's "Colonial Urban Development" begins to fill a long-standing lacuna in the urban literature. The book is divided into four sections. In the first section (chapters 1-3), King endeavors to fashion a conceptual framework for examination of the Anglo-Indian city. Drawing from recent writings on modernization and urbanization in the Third World and leavening these materials with insights derived from his own residence and research in South Asia, he argues that understanding of colonial urban development requires formulations designed to identify core values, patterns of behavior, and institutions that influence directly or indirectly the sociospatial forms of towns and cities established by European officialdoms. He admonishes that those centers should not be envisaged as mere replicas of settlements and societies in the West. Instead they represented unique and complex urban amalgams, incorporating cultural, economic, and technological elements from both metropolitan and indigenous hearths. Echoing the ideas of George M. Foster (*Culture and Conquest: America's Spanish Heritage* [Wenner-Gren Foundation, New York, 1960]), Edgar Wickberg (*The Chinese in Philippine Life, 1850-1898* [Yale Univ. Press, New Haven, Conn., 1965]), Pauline D. Milone (*Indische Culture, and Its Relationship to Urban Life, Comparative Studies in Society and History*, Vol. 9, 1967, pp. 407-426), and others who have studied the process of acculturation in colonial situations, King asserts that a "colonial third culture" emerged in the cities of British India. This hybrid cultural form, which incorporated the cumulative experiences of countless European sojourners in scattered outposts of the empire, served as the catalyst of Anglo-Indian urbanism.

In Part Two (chapters 4-7) King identifies the main morphological expressions of the colonial third culture. His commentary on the eclectic nomenclature utilized by colonists to define and describe their urban environments provides considerable information regarding the

nature of social, economic, and political relationships between the English and Indians. The cantonment, a sprawling military camp associated with most colonial cities in South Asia, is treated as an institutionalized type of settlement essential to the legitimation of British authority. King observes that the physical structure of such reservations and the behavioral patterns of the occupants were highly standardized in order to project an image of order, stability, and power. His examination of residential areas focuses on the values, habits, and ideals that led to comparatively uniform modes of space utilization in the "bungalow-compound complex" occupied by each European family. King highlights the role of hill stations as dynamic enclaves of Western culture where formal and informal activities were designed to evoke an atmosphere of home. Physically separated by time and distance from the lowland stations of civil servants, military personnel, missionaries, and businessmen, the hill towns, as King reminds us, functioned effectively as powerful instruments of social integration for the alien community.

The third part of the book (chapters 8–10) is a case study of Delhi's transformation from a declining nucleus of Moghul power into the administrative headquarters of the subcontinent. This part is important because of the paucity of historical studies that examine the emergence of Delhi as a multifunctional colonial capital and symbolic hub of Asian empire. Although he emphasizes the formative influence of Europeans in the process of urban transformation, King appropriately devotes somewhat more attention to the place of the Indian majority in their evolving metropolis. He is concerned not only with "New Delhi" as planned by the British but also with "Old Delhi" as modified by the foreign elite. King does not lose sight of the inexorable social and political forces by which the two cities of markedly different cultural origins were merged into a single urban fabric. The commentary on Delhi occupies almost a third of the text. In view of the length, it is curious that no mention of the Indian capital is made in either the title or subtitle.

The final part (chapter 11) unfortunately offers more in the way of truisms than in challenges for future research. Like other students of Third World urbanism, King notes the persistence of certain socioeconomic structures established by the Europeans for an indeterminate period after independence. The postcolonial city thus tends to remain compartmentalized, as indigenous officialdoms assume the authority roles of their Western predecessors and occupy their residential areas.

King recognizes the importance of pictorial material as a source of data as well as illustration, and he has included dozens of photographs of urban scenes in British India. Unfortunately, their reproduction is very uneven in quality. Still more bothersome is the separation of figures embedded in the text from captions and documentary evidence in the appendix. Maps are likewise difficult to read and interpret. Those copied from items in the archives of the India Office vary in clarity and utility, and some are rendered almost illegible by reduction in size.

Despite the reproduction problems, the book is conceptually innovative, thoroughly documented, and rich in information on Indian urbanism. It represents at once a pioneering statement on the emergence of the modern city in South Asia, a recent history of Delhi, and a mirror of King's evolving thoughts on the processes and consequences of colonial urbanization. As such the work should have broad appeal not only to social scientists but also to historians, architects, planners, and others with an interest in the development and form of cities founded during the nineteenth-century heyday of European industrial and imperial expansion. There is little doubt that this book fills an important niche in the literature on comparative urbanism and should inspire additional studies of the colonial urban genre.—ROBERT R. REED

WATER AND TRIBAL SETTLEMENT IN SOUTH-EAST ARABIA: A Study of the Aflāj of Oman. By J. C. WILKINSON. xvi and 276 pp.; maps, diags., bibliogr., index. Clarendon Press, Oxford, 1977. \$28.50. 9¾ x 7¼ inches.

This outstanding book uses a framework of the constraints of physical geography and the techniques of irrigation to describe and analyze the economy and organization of tribal societies in one of the least-known inhabited parts of the world. Wilkinson resists the tempta-

tion of physical determinism for the analysis of human activities in this arid region (annual rainfall mainly under 100 millimeters); instead he stresses changes and diffusion brought about mainly by conquest and civil wars in the evolution of economic and social institutions. For example, he concludes that the prevailing method of obtaining water for irrigation by underground tunnels from aquifers (*aflāj*) was introduced by Achaemenid Iranians about the sixth century B.C. and that the system was improved during Iranian Sassanid rule between the third and seventh centuries A.D., when the introduction of Roman techniques of cementation permitted diffusion of *aflāj* development from northwestern Oman (mainly the Buraimi area) into central Oman. The Muslim conquest in the seventh century resulted in complete replacement of Iranians by Arabs. Today's Arab population has no records or recollection of earlier historical eras, and thus the origin of the *aflāj* system is unknown to them. They attribute it to the mystical King Solomon.

Unlike Iranians, Arabs in southeast Arabia use the word "*aflāj*" to describe both underground tunnels and open channels that direct water from wadis to irrigated areas. Much capital is required for construction and maintenance of the *aflāj*. But in this region landownership is characterized by small units from which not much capital may be accumulated. Thus the pattern of ownership is not conducive either to maintenance or to further extension of the *aflāj* system. Much decay of irrigation has taken place since the Arab conquest, although in some periods—for example, during the Ya'ariba Immanate, circa A.D. 1650–1725—strong rulers initiated improvements and extensions.

The dichotomy between technology (and economic requirements) and social structure is reflected also in the local legal structure and is described by Wilkinson in fascinating detail. Water is divided among the many landowners by time of flow. To determine this division by observations of the length of shadows in daytime and by the stars at night is no mean achievement, considering that the flow of water fluctuates with the seasons (the author confirms that summer rainfall is not significant in the region, except for Dhofar). This system of water division also encourages distribution by main canals from the end of the *aflāj* rather than by subsidiary canals because evaporation or seepage water in subsidiary canals cannot be that equitably divided among many claimants. Overall distribution by main canals is wasteful, but it is well adapted to the diffused landownership pattern of the area. In some *aflāj* areas the measured division of water is supplemented by auction sales to highest bidders.

Today the working of *aflāj* irrigation is further handicapped by the emigration of labor to oil-producing areas. Specialists for *aflāj* maintenance and construction always had to be imported to the region, mainly from Iran. The author has calculated that the areas irrigated by *aflāj* formerly produced a huge surplus of dates for export, usually to India. At present the exports have ceased, although the local population has increased neither in numbers nor in affluence. The most regular flow of water from the *aflāj* is used for date growing; less-reliable permanent flows farther from the *aflāj* are used for cultivation of alfalfa, while seasonal flow irrigates cereals. Beyond the irrigated areas animals are grazed; farther away, the mixed herds of nomads; and farthest the camels of the true desert nomads. This sequence of land use centered on the *aflāj* results in a von Thünen-type pattern, apparently without its determinants of transportation costs.

Wilkinson applies the Ibn Khaldun model of societal change in an analysis of relationships between tribal migrations and political control in the region. According to this thirteenth-century Arab historian, nomadic desert bedouin take over sedentary regions in a series of stages, as happened before and during the Muslim conquest. However, since Sassanian days the decaying *aflāj* irrigation area offered no economic inducement to take-over. Thus, in contrast to Ibn Khaldun's model, an equilibrium of coexistence between nomadic desert grazing and *aflāj* irrigation evolved that has resulted in an apparently stable tribal structure since the Muslim conquest. This political stability is confirmed in a geographical context by interesting evidence of tribal distributions during the last centuries. In conclusion, Wilkinson asks, "Have any of the traditional institutions in their original form a really constructive part to

play in the planning of the future? The answer must in all truth be 'no.' " Probably some adaptations by traditional institutions may be expected, but in view of the rapid replacement of the camel by the truck, of the introduction of diesel pumps, and of the high level of emigration, very radical changes in social development will occur in this region.—ALEXANDER MELAMID

EUROPE 2000. Edited by PETER HALL. 274 pp.; tables, bibliogr., index. Columbia University Press, New York, 1977. \$15.00. 8¼ x 5½ inches.

Speculation about the future is a favorite human pastime, the ultimate in escapism with the added stimulant of seeing the inexorable march of events either vindicate or mock one's predictions. Recently, futurism has attempted to become a precise field by using the trends of the past and the techniques of the present to arrive at some misty idea of what may lie ahead. Applying devices such as modeling theory and delphic technique, futurists create a selection of scenarios, ranging from optimal to "worst case" on an encyclopedic assortment of questions. To its advocates, futurism permits intelligent choices based on best current knowledge; cynics argue that it uses past mistakes to forecast future ones, or at best, creates self-fulfilling prophesies.

In any case, the future is a definite growth industry, and one in which geographers are finding stimulating and rewarding participation. Courses in "Future Worlds" proliferate, and geographical variables are extended through both time and space to create an intriguing body of research. Moreover, the year 2000, with the heavy weight of artificial significance imposed on it by the Western numbering system, is now at just about the right point in its approach to attract futurists from all quarters. There is a mystic symbolism about its symmetry: something momentous will surely happen! We can confidently expect to be deluged over the next few years with predictions for 2000 ranging from Nirvana to Armageddon.

Although many forecasts about the world in the year 2000 will be little more than lurid fantasies designed primarily to sell books, some serious studies should serve as the basis for long-range planning efforts and may help governments, institutions, and individuals make informed decisions. "Europe 2000" is such a study, and it is difficult to see how it could be improved as a guide to the European future. The book is the end product of a process of synthesis that began in 1967, when the European Cultural Foundation undertook a massive research project to study Europe's future and in which more than two hundred experts from ten different countries participated. Some idea of the scale of "Plan Europe 2000," as it was known, may be gathered from the fact that some \$3 million was expended between 1967 and the project's conclusion in 1976.

The work was divided into four major projects on the general themes of education, industry, urbanization, and agriculture/environment. The final reports of the working groups were published separately between 1976 and 1977 (some twenty other specialized reports preceded these), and a sixteen-member Integration Committee, chaired by Peter Hall, worked from 1974 into 1976 to prepare the present volume. The list of participants resembles a "Who's Who" of imaginative intellectual, business, and political figures in contemporary Europe, and it is virtually impossible to imagine a scenario this side of sheer fantasy that has not been articulated somewhere in this report.

The book provides abundant recent data and an excellent bibliography. While it is clear that Hall struggled to integrate, synthesize, and edit what was undoubtedly a small mountain of committee reports and supporting documentation (even allowing for the labors of the Integration Committee), his stylish writing, insightful comments, and unfailing selection of the *mot juste* make the work sufficiently literary to give it a wide appeal. The reader is reminded too often of what has been presented in the past chapters and of what is coming in future ones, and there are a small number of factual errors (that world population growth is still running at 2 percent per year), and dubious interpretations (that Alaskan oil will largely replace United States imports for the short term); but these only strike the eye because they are so few in a type of book that usually contains many more.

The real Europe is here, warts and all, and it rings absolutely true. No trend, possibility, or threat has been ignored or downplayed for reasons of public relations. Hall avoids the tendency to dwell on the folklore of history that characterizes much writing on Europe today and that explains so little. The implications of potential Communist governments in various Western European nations, the rise of terrorism, the new regionalism that threatens further fragmentation of the political structure even as the European Community tries to integrate and simplify it, the meaning of the vast social and economic upheavals that are making the old answers so unacceptable throughout the continent, are all to be found here, dispassionately discussed and arrayed in a kind of ideological supermarket. Readers (and presumably those who will be making many of the future's critical decisions) are able to assess the probability of various events, to consider the available policy options, and to add up the social and economic costs involved.

Certainly one of the most important books about Europe to appear in many years, "Europe 2000" is an ideal starting point for anyone who wishes to understand what is really happening on the modern scene. Whether or not the authors and the sponsoring foundation will ultimately have much impact on the course of events, they have outlined the forces, choices, and consequences with remarkable clarity. There are no comfortable conclusions and no simplistic solutions to complex problems; that, after all, is the way the future usually is.—JAMES R. McDONALD

ABSTRACTS OF ARTICLES

GEOGRAPHICAL REVIEW

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Changing Concentrations of Older Americans

THOMAS O. GRAFF and ROBERT F. WISEMAN

The spatial distribution of persons aged 65 and older in the United States is examined for 1950 and 1970. A descriptive analysis is undertaken of maps depicting the county concentration of elderly people relative to total county population. The national pattern of local concentration is found to vary considerably between the two time periods. A westward shift of the region of highest concentration is clearly observable and apparently mirrors earlier settlement patterns. The demographic processes that produce these patterns are discussed, with special attention devoted to the recent growth of retirement communities. Changes in the patterns result primarily from aging-in-place, which is often coupled with out-migration of younger cohorts. The study concludes with speculations on the future geographical distribution of concentrations of older Americans.

Cedar and Mahogany Logging in Eastern Peru

STUART WHITE

Cedar and mahogany logging on the forest frontiers of eastern Peru are rudimentary in their scale of operations and methods of wood extraction. These enterprises are poorly financed and must contend with various environmental constraints. In the absence of power tools or vehicles, logs must be laboriously transported with levers and a primitive windlass, then floated down tributary streams. When the logging operation is completed, the process of forest regeneration begins at three sites of disturbance: along extraction pathways, at the tree stump, and in camp areas. Seed, soil, and microclimate conditions following selective logging favor the rapid restoration of the mature forest, unlike the conditions typical of clear-cutting for timber or agriculture. And because cedar and mahogany have pioneering qualities that allow them to prosper in disturbed areas, they are likely components of the regenerated forest.

Forest Preservation in the Western Highlands of Guatemala

THOMAS T. VEBLEN

In contrast to most of highland Guatemala, much of the department of Totonicapán remains under a forest cover. The forests of Totonicapán have been preserved in spite of extreme pressures on the land resulting from the high rural population densities. Comparison of old and recent aerial photographs indicates that the boundaries between forested and nonforested land have remained remarkably stable despite the rapid population growth of recent decades. The preservation of the forests of Totonicapán is attributed principally to fortuitous historical-economic circumstances that led to an early recognition of the commercial importance of the forest resource, to development of a communal pattern of forest ownership of both pre-Hispanic and Spanish colonial origin, and to the realization by the Indian inhabitants of the importance of the income and products derived from the forest resource to their continued cultural independence.

Rural Revolution in East Carolina

JOHN FRASER HART and ENNIS L. CHISTANG

Rural areas in eastern North Carolina have been revolutionized by the recent mechanization of flue-cured tobacco production. Field layouts have been changed, farm operations have been dispersed over large areas, and some farm operators have become sidewalk farmers. Farm workers released by mechanization have found jobs in large new factories that have been attracted to the area by the availability of labor. Many factory workers prefer to remain in the countryside, and they commute long distances to their jobs. Huge new rural factories, rows of new brick homes along rural roads, and batteries of new bulk-curing barns at the old farmsteads are among the most dramatic landscape manifestations of the rural revolution in eastern North Carolina.

Excursionary Zoning and Open Housing: A Brief Judicial History

PAUL E. KING

The evolution of exclusionary zoning is reviewed from the first emergence of land use controls at the local level to recent U.S. Supreme Court decisions on the issue. Early conflicts surrounded the delegation of the police power from the states to local municipalities. After 1926, however, zoning became established and was widely applied until 1945. Associated with the rapid suburbanization following World War II exclusionary devices flourished, but after 1965 a changing judicial climate led to the overthrow of numerous ordinances by state courts. This antizoning trend notwithstanding, there is legal precedent for exclusion when it is tied to comprehensive development plans and slow-growth ordinances. Federal courts have taken a very conservative stance on local land use cases, and the conclusion is reached that exclusion will continue as long as local interests outweigh metropolitan or regional concerns.

Predicting Microlevel Population Change

DAVID J. MORGAN and GUNDARS RUDZITIS

Recent shifts in the demographic structure of the United States have led to a general decrease in the number of children in schools across the country. National trends and statistics are of little use, however, in predicting microlevel changes that help local communities plan for population shifts. This article describes a study of microlevel population change and outlines some significant results. It also provides a model for other such analyses. The model is not restricted to microlevel studies, however, nor to school enrollments, since the scale and subject matter can be expanded to cover any geographical or substantive area.

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ERRATA

p. 46, insert caption, FIG. 7—Productivity in the port of Dar es Salaam, 1971-1975. Compiled from data supplied by the East African Cargo Handling Services Ltd., Mombasa.

p. 53, line 22, for 9s. 4d. or 11s. 7d. read 9.4d or 11.7d

p. 239, line 14, for ealry read early

p. 367, line 48, for expansionist read expansionist